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ABSTRACT

This manual on tires and tracks servicing is one of a series of power mechanics texts and visual aids on operation, diagnosis and repair of automotive and off-the-road agricultural and construction equipment. Materials provide basic information and illustrations for use by vocational students and teachers as well as shop servicemen and laymen. The first of the manual's two parts focuses on tires and discusses topics such as construction of tires, tire sizes, ballast, dual tires, tire failures, tire repairs, mounting and demounting tires, and changing agricultural traction tires. Focusing on tracks, part 2 discusses topics such as track shoes, track rollers and sprockets, adjusting tracks, diagnosis of track wear, roller wear, removing tracks from machine, and installing tracks. Each part concludes with test questions. Answers to the test questions are appended. (A supplementary 35mm color slide set is also available--see availability note.) (LRA)

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Tires and Tracks

JOHN DEERE

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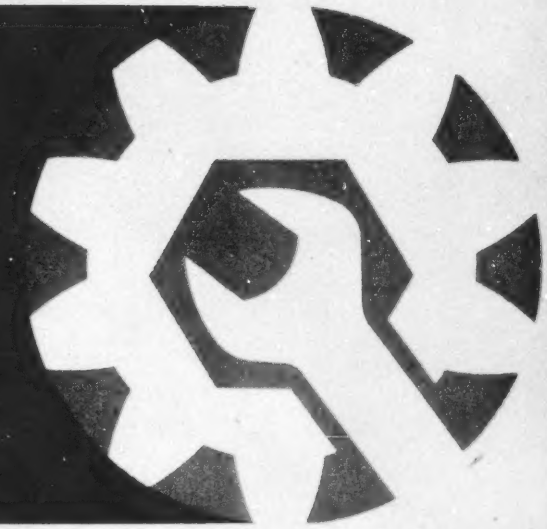

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TO THE READER

PURPOSE OF THIS MANUAL

The main purpose of this manual is to train the reader so that he can understand and service tires and tracks with speed and skill. Starting with "how it works," we build up to "why it fails" and "what to do about it." For the novice, it is a training guide; for the journeyman a reference. The manual is written in a simple form using many illustrations so that it can be easily understood.

WHAT IS "FUNDAMENTALS OF SERVICE"?

This manual is part of a series of texts and visuals called "Fundamentals of Service", or "FOS". These materials are basic information in power mechanics for use by teachers as well as shop servicemen and the layman. All types of modern equipment are covered — both automotive and off-the-road. Emphasis is on theory of operation, diagnosis, and repair.

OTHER MANUALS IN THIS SERIES

John Deere is preparing a series of these manuals called "Fundamentals of Service," or "FOS."

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TIRES / PART 1

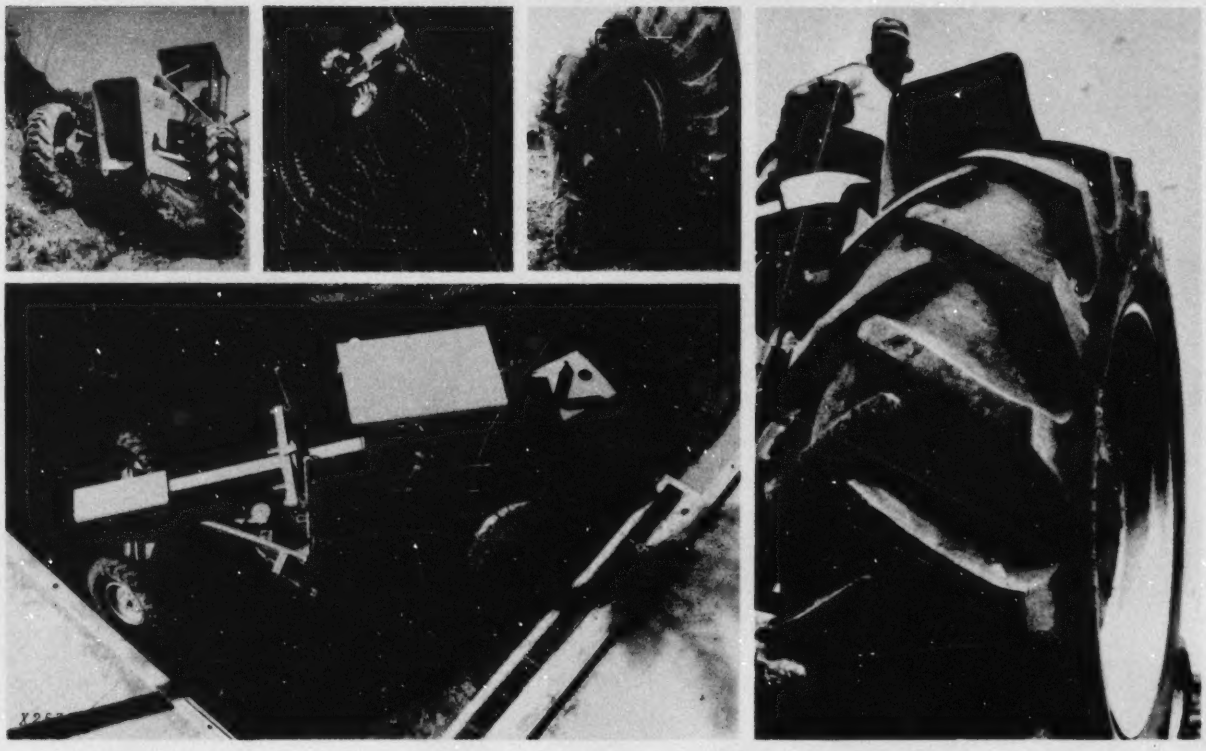

Fig. 1 — Pneumatic Rubber Tires On Modern Off-The-Road Machines

INTRODUCTION

Pneumatic rubber tires are used on almost all modern wheel machines.

Tires are designed for two general uses:

- **Over-The-Road Tires — for speeds over 30 mph**
- **Off-The-Road Tires — for speeds less than 30 mph**

OVER-THE-ROAD TIRES flex faster and generate more heat but receive less shock flexing from obstacles than off-the-road tires.

OFF-THE-ROAD TIRES operate at lower speed and generate less heat, but must be tougher to take the shocks of obstacles like rocks, stumps, and rough terrain.

Some tires, such as truck tires, are designed to satisfy both conditions.

Within each area, a wide variety of tires are available, with different sizes, plies, profiles, and treads.

Service of over-the-road tires is usually done at a service station, but for many off-the-road tires, service is performed in the field. Our discussion of tire repairs will be mainly on the field repair of off-the-road tires.

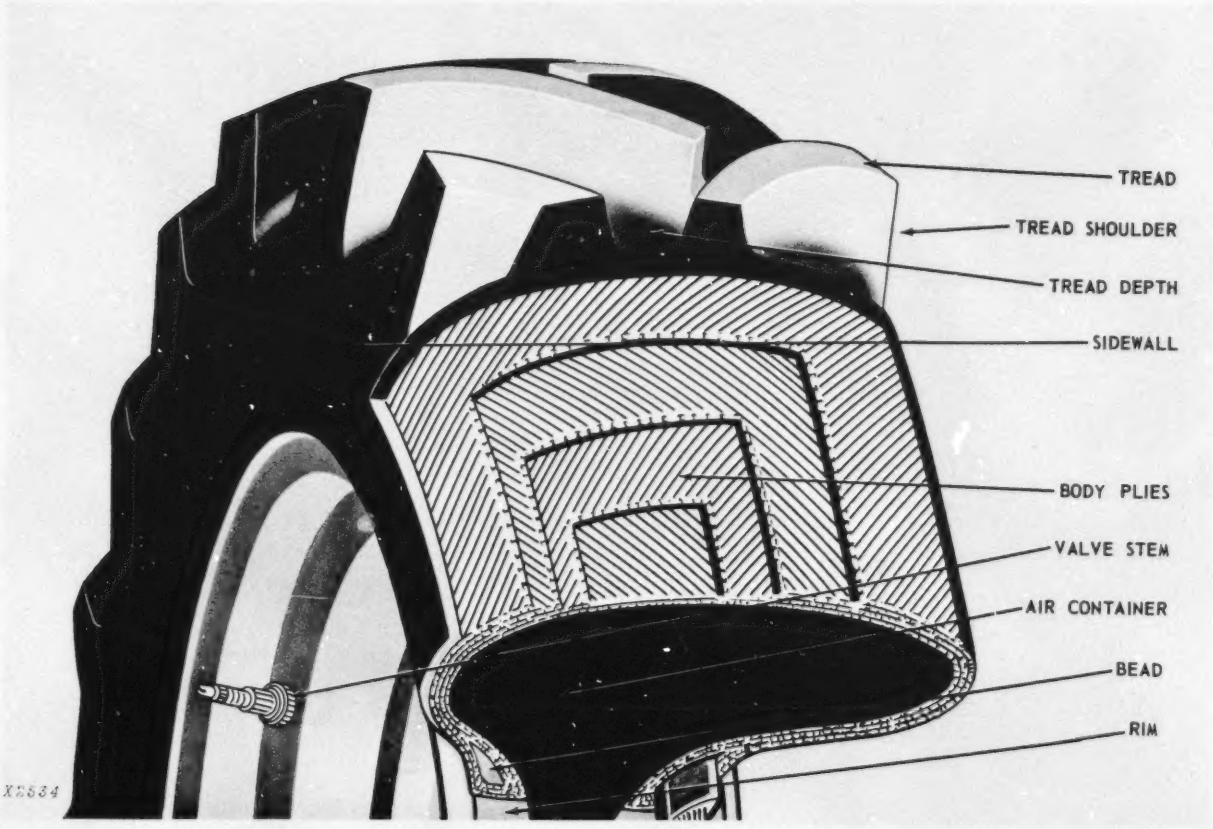

Fig. 2 — Cutaway View of Tire

CONSTRUCTION OF TIRES

The cutaway view of a tire in Fig. 2 permits you to see the vital parts of any pneumatic tire. The function of each part is given below.

BEAD

Tire beads anchor the tire to the rim, and are the foundation of the tire. All tire plies are tied to these strong bundles of wire which prevent any change of shape or fit on the rim — one or more bead stacks may be used as required.

BODY PLIES

Layers of rubber-cushioned cord or fabric make up the body. The strength built into this part of the tire holds in the inflation pressure which supports the load and cushions the shocks. Each cord in each ply is completely surrounded by a resilient rubber compound and each ply is insulated from the next by a layer of the same compound.

The cord material may be of cotton, rayon, nylon, polyester, or other materials. Rayon and nylon are most popular; however, polyester is fast coming into the picture.

A tire may have any number of cord plies: from 2, 4, or 6 (usually for automobiles, station wagons, and light pick-up trucks); 6 to 14 for larger trucks; and up to 20 or more for large off-the-road equipment.

Ply Rating

All tires for off-the-road use are ply-rated. Once the ply rating told the actual number of plies in the body of the tire. Now it identifies a given tire with its recommended load when used in a specific type of service.

Ply rating tells the strength, but does not necessarily tell the number of cord plies in the tire. For example, many tires with a 4-ply rating may only contain 2 plies. This simply means that the plies have added strength and will carry the load of a tire that actually has 4 plies.

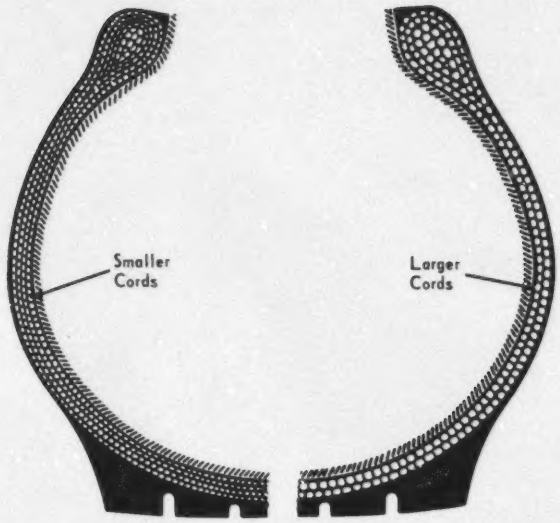

Fig. 3 — Construction of 2- and 4-Ply Tires Compared

Fig. 3 compares 2- and 4-ply tire construction. To get the same strength, note how 2-ply tire cords are larger.

NOTE: Automotive and truck tires are now identified by "load range" rather than ply rated.

Bias Ply

In normal tire construction the ply cords run from one tire bead to the other at an angle (left, Fig. 4).

Alternate plies of the body run in opposite directions. This bias construction gives rigidity to both the sidewall and the tread.

Belted Bias Ply

In belted bias, the tire body is similar to that of the bias tire but the body is surrounded by fairly rigid belts (center, Fig. 4). These belts are composed of very low angle cords which surround the tire body underneath the tread. This gives rigidity to the sidewall and even more rigidity to the tread. The belts reduce tread motion during contact with the road, thus improving tread life.

Belted Radial Ply

Here the body cords run across the body from bead to bead at almost a right angle (Fig. 4). Fairly rigid belts, composed of cords surround the tire body underneath the tread. As in belted bias tires, the belts reduce tread motion during contact with the road, thus improving life. This construction gives better support to the tread.

Wire-Reinforced Ply

In some big tires for earthmoving and other equipment, a layer of wire (Fig. 5) is cured between the tread and the body of the tire. This protective layer of wire keeps most cuts from penetrating into the body, keeps tread cuts from growing, and holds tread cuts closer so sand and dirt will not enter and cause separation.

Some tires are marked "SWB" (shredded wire braid) on the sidewall.

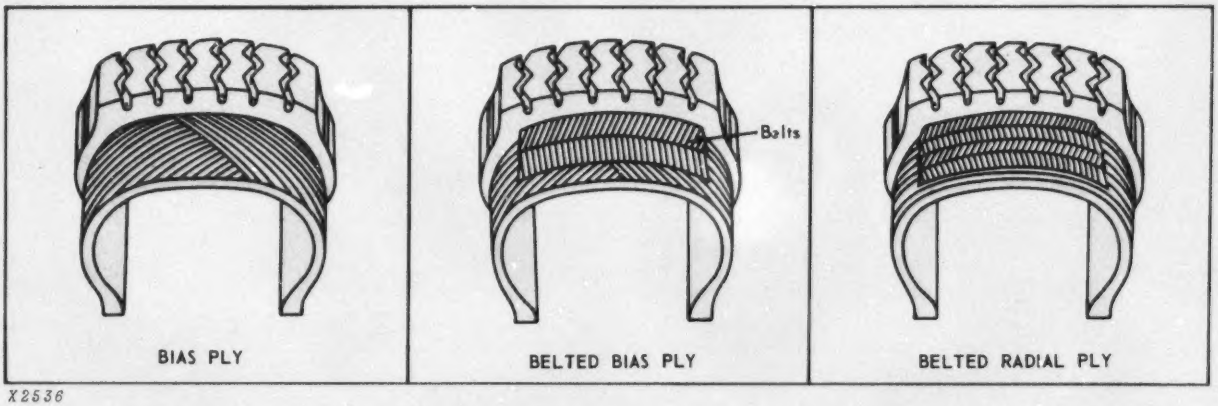

Fig. 4 — Ply Construction of Tires — Three Types

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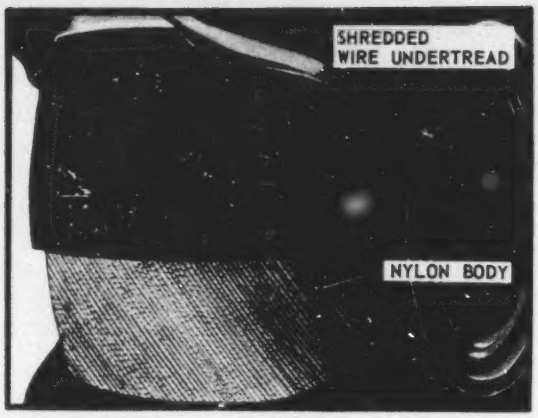


Fig. 5 — Wire-Reinforced Construction Of Heavy-Duty Tire

SIDEWALLS

Sidewalls are the rubber coverings on both sides of the body. They are designed to flex and bend without cracking during both ordinary deflection and extreme sudden shock.

TREAD

The tread is the part of the tire which contacts the road. It must provide traction for most machines, provide long wear and resist cuts. Tire treads have many patterns and depths for various types of service.

TUBELESS INNER LINER

The liner (not shown) is an integral part of the tubeless tire, covering the inside from bead to bead. The liner in the tire serves as the air retainer. It reduces weight by eliminating tubes and flaps and gives easier maintenance.

TUBE

The function of the inner tube in a tube-type tire is to retain air, inert gases, or liquid under pressure within the tire cavity under full pressure.

FLAPS

On tube-type tires, the flaps protect the tube from injury by contact with the rim and tire beads.

RIM

The rim is that part of the wheel which provides metal support for the tire.

CODES FOR TIRE TYPES

Many types of tires are used, especially in agriculture. For simplicity, a uniform code has been adopted by both The Tire and Rim Association and The Rubber Manufacturers Association (RMA).

Fig. 6 — Code for Tire Type Stamped On Side of Tire

The standard code is marked on the side of the tire and normally consists of a letter plus a number (Fig. 6). See chart below.

For example, the letter "R" denotes a rear tractor tire . . . the number following tells the specific type of rear tractor tire.

STANDARD INDUSTRY CODES FOR TIRE TYPES*

Type of Tire	Code
FRONT TRACTOR	
Rice tread	F-1
Single rib tread	F-2
Dual rib tread	F-2D
Triple rib tread	F-2T
Industrial tread	F-3
DRIVE WHEEL TRACTOR (REAR)	
Rear wheel, regular tread	R-1
Cane and Rice, deep tread	R-2**
Shallow, non-directional tread	R-3
Industrial, intermediate tread	R-4
IMPLEMENT	
Rib tread	I-1
Traction tread	I-3
Plow tailwheel	I-4
Smooth tread	I-6
OFF-THE-ROAD TIRES (INDUSTRIAL)	
Rib	E-1
Traction	E-2
Rock	E-3
Rock deep tread	E-4
Rock intermediate	E-5
Rock maximum	E-6
Flotation	E-7

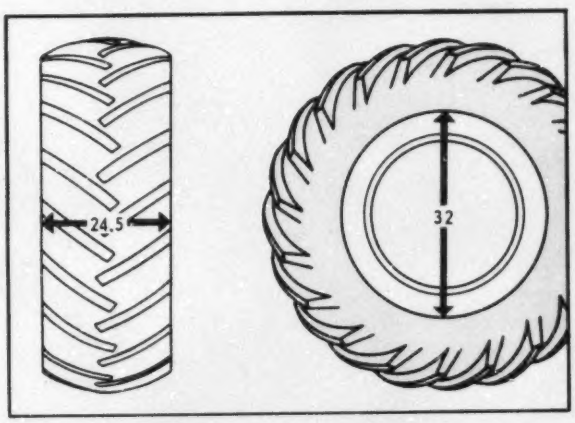
Also includes similar treads for "G", "L", and "ML" series codes.

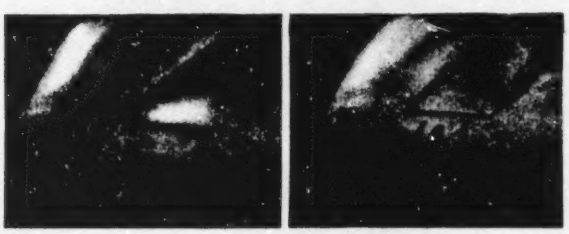
(Notes On Chart, Page 4):

**Few tire manufacturers make all the types for which codes are established. However, all similar tires will be marked with identical codes. Whenever you are not certain which particular tire is best for your purpose, consult a reputable dealer for advice.*

***Some manufacturers add the letter "O" after the industry code to denote an "open tread" design, and the letter "C" to denote a "closed tread" design in the R-2 classification.*

TIRE SIZES – WHAT THEY MEAN





NORMAL SIZING DUAL SIZING

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Fig. 7 — Tire Sizes Marked On Sidewall of Tires

Fig. 7 (left) shows a typical size marking on the sidewall of an off-the-road tire. The "24.5" tells the section width of the tire in inches when mounted on its recommended rim. The "32" gives the nominal diameter (in inches) of the rim.

DUAL SIZING FOR TRACTOR DRIVE WHEEL TIRES

About 15 years ago, new extra wide base rims were adopted for rear tractor tires. This permitted the tire beads to be spaced wider apart on the rim, giving the tire a wider, more stable base and a wider cross section.

Prior to this, tire size markings were general and did not indicate the approximate tire section width as does the 12.4 tire when mounted on an 11-inch rim (for example: an 11-28 tire actually had a tire section width of 11.90 inch when mounted on a 10-inch rim).

In dual sizing (as shown at right in Fig. 7), the old sizing is generally shown second and is the smaller size. Gradually, as the older type (narrower) rims become obsolete, dual size will be eliminated and only the size for wide base rims will be shown (as pictured for the 24.5-32 tire size).

DIRECTIONAL ARROWS ON TIRES

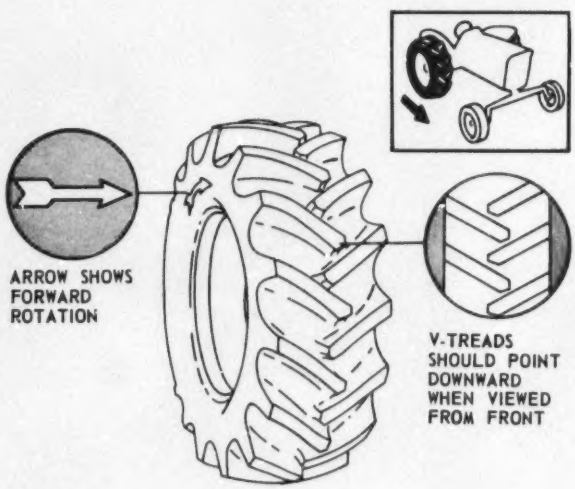

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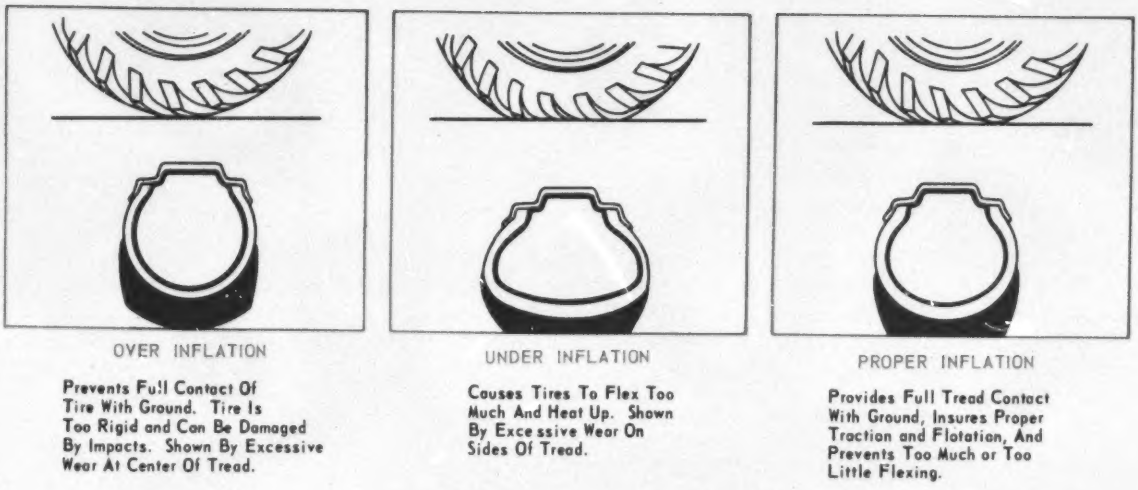
Fig. 8 — Directional Arrow On Drive Wheel Tire For Farm Tractor

Drive wheel tires on many machines must be mounted to rotate in a certain direction for best traction. For this reason, directional arrows (Fig. 8) are often stamped on the sidewall to show forward rotation. This is most important on agricultural V-tread tires where the "V" pattern must point downward when viewed from the front.

Reversing the tread will damage the tread bars when the tractor is pulled under heavy load. (Only on ground-driven implements such as planters and spreaders should the V-tread be reversed).


OVER INFLATION
Prevents Full Contact Of Tire With Ground. Tire Is Too Rigid and Can Be Damaged By Impacts. Shown By Excessive Wear At Center Of Tread.
UNDER INFLATION
Causes Tires To Flex Too Much And Heat Up. Shown By Excessive Wear On Sides Of Tread.
PROPER INFLATION
Provides Full Tread Contact With Ground, Insures Proper Traction and Flotation, And Prevents Too Much or Too Little Flexing.

X2541

Fig. 9 — Tire Inflation

TIRE INFLATION

Proper inflation is vitally important to proper service life of the tire. Tires are designed to operate with a certain sidewall deflection or "bulge." Correct air pressure insures proper traction, flotation, support of load, and prevents excessive flexing of the tire which could cause overheating.

NOTE: Tire inflation pressures are given in pounds per square inch (psi). When an inflation pressure is discussed here, it will be followed by "psi," for example, "inflate to 35 psi."

OVERINFLATION

Overinflation prevents full contact of the tire tread with the ground or road (left, Fig. 9). This subjects the center of the tread to excessive wear. Because the tire is more rigid, it is more liable to damage by striking curbs, rocks, and other objects which can cause breakage of the cord plies.

UNDERINFLATION

Underinflated tires flex excessively at every turn of the wheel, resulting in high internal heat and premature failure. Underinflation is indicated by excessive wear of the sides of the tread while the center is relatively unworn.

PROPER INFLATION

Correctly inflated tires (right, Fig. 9) permit all of the tread to contact the ground, yet are not soft enough to flex excessively.

PRESSURE GAUGE

Proper inflation must be maintained at all times and all seasons. This makes it important that an accurate pressure gauge be used when checking inflation pressures. Two types of pressure gauges are usually available — high-pressure and low-pressure — for either dry or liquid testing. Always use the proper type gauge when checking pressure. Normally, high-pressure gauges are not satisfactory for checking low-pressure tires as the gauges are usually calibrated in five-pound increments while low-pressure gauges are calibrated in one-pound increments.

Most important is that the gauge be accurate. Accuracy can only be determined by checking the gauge against a gauge of known accuracy. For this reason, keep one accurate gauge for the sole purpose of checking the accuracy of the gauge normally used. This is especially true of low-pressure gauges. Fig. 10 illustrates a low-pressure tire gauge.

M 4166

Fig. 10 — Low-Pressure Tire Gauge

HOW TO INFLATE TIRES

Proper inflation is perhaps the most important part of tire service. Here are some of the rules:

1. **Always check and inflate, if necessary, when the tires are cold.** This is very important since, as the tires become heated through use, the air expands and the pressure increases. This is normal and in the case of automotive tires, the pressure may increase 4 to 6 psi. In truck and industrial tires, the pressure may increase much more.

NOTE: In some industrial tires it may take as long as 24 hours or longer for the tire to return to normal temperature.

2. **Never "bleed" pressure from hot tires.** This invariably results in the tire pressure being too low when its temperature becomes normal, often resulting in tire damage when put to work. Either reduce the load, the speed, or both.

3. **If a tire becomes low while operating, adjust the pressure to the same as that of another tire of the same size on the vehicle.** Recheck the pressure after about 30 minutes of operation to be sure it is still correct.

4. **Always use a liquid-type pressure gauge when checking pressure in tires with liquid ballast. Check the pressure with the valve stem at the bottom.** Always wash the gauge with clean water after checking the tires.
NOTE: If it is impossible or undesirable to check the pressure with the valve stem at the bottom, locate the stem at the top. Add about ½ pound to the pressure gauge reading for each foot height of liquid in the tire for the actual pressure, depending upon density of ballast.

CAUTION: Failure to follow proper procedures when mounting a tire on a wheel or rim can produce an explosion which may result in serious injury or death. Do not attempt to mount a tire unless you have the proper equipment and expertise to perform the job.
When seating tire beads on rims or wheels, never exceed maximum inflation pressures specified by tire manufacturers for mounting tires. Inflation beyond this maximum pressure may break the bead, or even the rim, with dangerous explosive force.

INFLATING TRACTOR AND IMPLEMENT TIRES

Farm tractor and implement tires operate most of the time in field conditions where the lugs can penetrate the soil, and where all the width of the tread contacts the ground. When operating over hard-surfaced roads, with low inflation pressures, the tread bars squirm excessively while going under and coming out from under the load. On highly abrasive or hard surfaces, this action wipes off the rubber of the tread bars or lugs and wears them down.

If the tires are to operate for any length of time on roads or hard surfaces and the draft load is light, increase the pressure to the maximum recommendation to reduce wiping on the tread bars.

Check the machine operator's manual for tire inflation pressures under varying conditions. Be sure to follow these recommendations strictly.

BALLAST

Modern off-the-road machines are designed with adequate horsepower for their field or jobsite operation. However, machine weight by itself may not be sufficient for full traction and drawbar pull, resulting in tire slippage.

Farm tractors are the prime users of wheel ballasts, so our discussion will refer mainly to them.

TIRE TRACTION

Tire traction can be judged by looking at the tire tread pattern after pulling under load as given below.

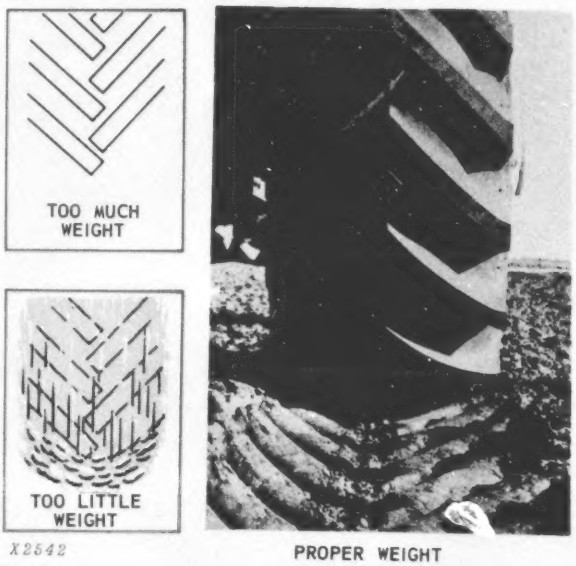


Fig. 11 — Tire Traction Patterns (Farm Tractor in Loose Soil Shown)

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TOO MUCH WEIGHT

When *too much weight* is used, the tire tracks will be sharp and distinct in the soil (Fig. 11) and there will be no evidence of slipping. This is bad, as the tires are literally geared to the ground and do not allow the flexibility of engine operation that is obtained when some slippage occurs.

TOO LITTLE WEIGHT

When the tires have *too little weight* they lose traction. The tread marks are entirely wiped out (Fig. 11) and forward progress is slowed. Not only is less work done but the tires wear excessively.

PROPER WEIGHT

When the tires have *proper weight,* a small amount of slippage occurs (Fig. 11). Usually, between 10 and 15 percent slippage is considered ideal in the field. When the tire is properly weighted, the soil between the cleats will be shifted but the tread pattern is still visible in the tire track as shown. Proper weighting allows the engine to perform at its best with maximum flexibility.

WHY BALLAST?

Tractor tires develop pull in relation to the amount of weight upon them. The greater the weight, the more tractive effort the tire can exert. However, weight causes compaction of the soil and increases the rolling resistance. The heavier the tractor, the more power that is required just to propel it across the soil surface. There is, therefore, an optimum weight for a given tractor under given conditions. The use of proper ballast is normally the best way to adjust for this optimum weight.

HOW MUCH BALLAST?

The amount of ballast which should be used depends on these factors:

1. Soil Surface

On loose or sandy soil, more weight is required to develop full power than on a firm surface.

The surfaces referred to as firm or tilled (loose) are generally soil surfaces. A firm surface might be an alfalfa cover crop or corn stubble. A tilled surface might be a plowed or disked field. These cover a broad range of specific soil conditions.

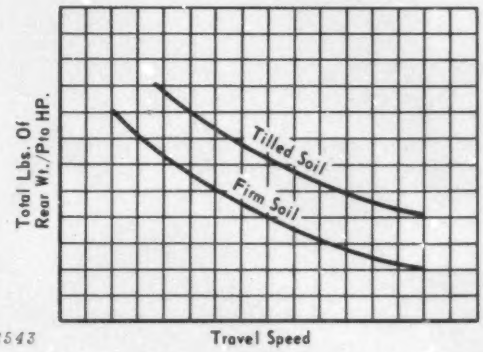

Fig. 12 — More Weight Is Required To Develop Full Speed and Horsepower In Loose Or Tilled Soil

Fig. 12 shows that more weight is required on a loose or tilled soil surface than on a firm surface for a given travel speed and horsepower.

2. Type of Implement

Some types of implements cause more weight to be transferred to the rear wheels of the tractor when under load than others. Thus, less ballast is required for integral or semi-integral (rear-mounted) than for towed implements. This is shown in Fig. 13.

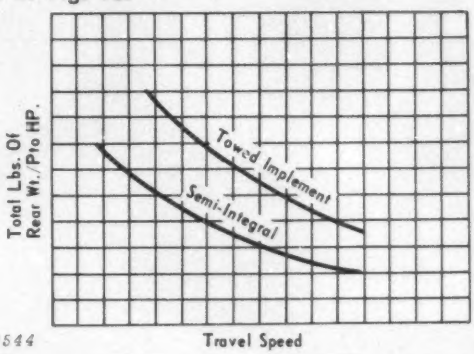

Fig. 13 — Less Weight Is Needed For Semi-Integral Implements

3. Travel Speed

Less weight is required at higher travel speeds than for operation at lower speeds. Figs. 12 and 13 both show decreasing rear weight as the speed increases.

4. Tractor Horsepower Output

At a given travel speed, the weight required is in proportion to the PTO horsepower output of the engine. Less weight is required for an 80-horsepower than for a 100-horsepower engine. Less weight is also required for a tractor that is not operating at full power. A tractor operating at ¾ load requires only ¾ as much rear weight as the same tractor operating at full load.

5. Tires

Tires have perhaps the least effect on ballasting requirements. However, better traction is usually obtained from over-size or dual tires. A tire operating at its full capacity cannot be expected to perform as well as one that is used conservatively.

A highly ballasted tire will also operate with the greatest ground contact pressure and cause more soil compaction.

Dual tires can be used to reduce unit ground pressure to help avoid excessive soil compaction (see page 13). They are also used when the carrying capacity of single tires is exceeded. However, adding dual tires does not necessarily mean that the rear weight must be increased.

HOW MUCH WHEEL SLIP?

Weight guides tell the amount of tractor weight required for a specific tractor under given conditions. However, they give only an estimate. The final criteria for adding ballast is the amount of travel reduction (% slip) of the drive wheels.

Under normal field conditions, travel reduction should be around 10-15 percent. Excessive slip requires that more weight be added to the drive wheels. If much less slip is obtained, *weight should be removed.*

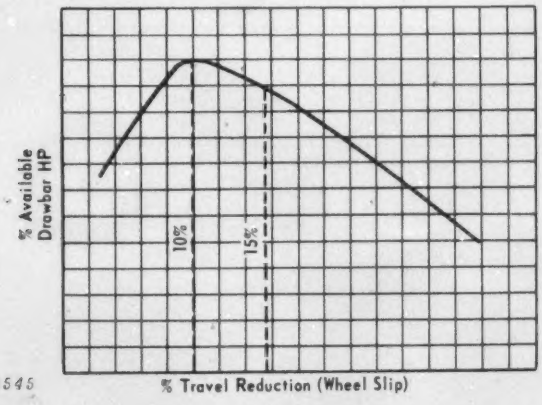

Fig. 14 — Horsepower Is Reduced When Drive Wheels Slip Too Much Or Too Little

A condition of zero slip is not a good one. Fig. 14 shows what happens to the available drawbar horsepower when too much or too little slip is allowed. Note that the available horsepower is greatly reduced when wheel slip drops below 10 percent.

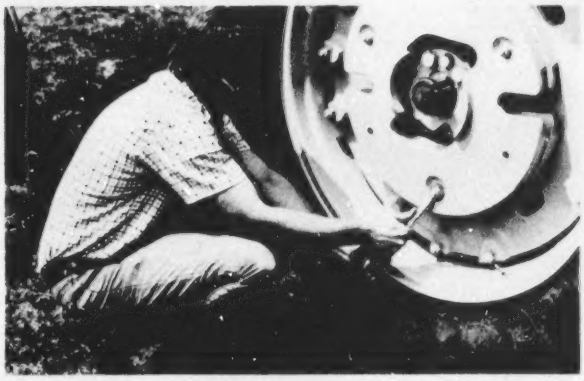

Fig. 15 — Ballast A Farm Tractor For Operation In Higher Gears — Usually 4 Mph Or Above

HOW TO MEASURE TRAVEL REDUCTION (WHEEL SLIP)

Travel reduction or wheel slip can easily be found by this method:

1. With chalk, make a reference mark on the side of the tire. Walk alongside the tractor while it is working and mark the spot where the chalk mark comes down to the ground.

2. Continuing along the side, count off ten revolutions of the wheel and again mark the spot where the chalk mark comes down to the ground.

3. Take the implement out of the ground and back the tractor between the marked spots, remarking the tire beside the mark on the ground. Count the number of revolutions of the wheel required to travel the distance between the two marks on the ground, estimating the last revolution as closely as possible.

4. Determine the slip as follows:

Revolutions	% Slip	Result
10	0	Remove
9½	5	Ballast
9	10	Proper
8½	15	Ballast
8	20	Add
7½	25	Ballast
7	30	

If less than 8½ revolutions is obtained, *weight should be added.* If more than 9 revolutions is obtained, *weight should be removed* from the rear wheels.

NOTE: The formula for calculating wheel slip is as follows:

R^1 = *Revolutions with no load over a given distance.*

R^2 = *Revolutions with load over the same distance.*

$$\text{Percent Slip} = \frac{R^2 - R^1}{R^2}$$

FRONT BALLAST (FOR TWO-WHEEL DRIVE MACHINES)

Front ballast does not contribute directly to traction on two-wheel drives but is required for stability and safety. Approximate front weight should be as follows:

For integral or semi-integral implements —
Front weight = ½ rear weight

For towed equipment attached to the drawbar —
Front weight = ⅓ rear weight

NOTE: The front weight should be increased more if necessary for safe operation of the tractor. Check the operator's manual charts.

BALLAST LIMITATIONS

Ballast should be limited by either the tire capacity or tractor capacity. Each tire has a recommended carrying capacity which should not be exceeded. If a greater amount of weight is needed for traction than is allowable on the tire, either a larger single tire should be used or duals should be considered. Tractor and tire life can be extended if ballast is limited to that required for continuous operation in the **higher** range of speeds, usually 4 mph or above.

Since ballast is usually added to a tractor and seldom removed for light loads or higher speed operation, a compromise is usually required. If the tractor is used mostly for high draft loads at low speeds, ballast for this type of operation. If more time is spent on light load utility work or at higher speeds, ballast for this operation and allow more slip for the smaller time spent on high draft work.

TRACTOR WEIGHT GUIDES

The tractor weight guides illustrated in Figs. 16, 17, and 18 can be used to determine the amount of ballast to be added. The guides indicate the pounds per PTO (power take off) horsepower of rear tractor weight under various soil and implement conditions.

INTEGRAL IMPLEMENTS

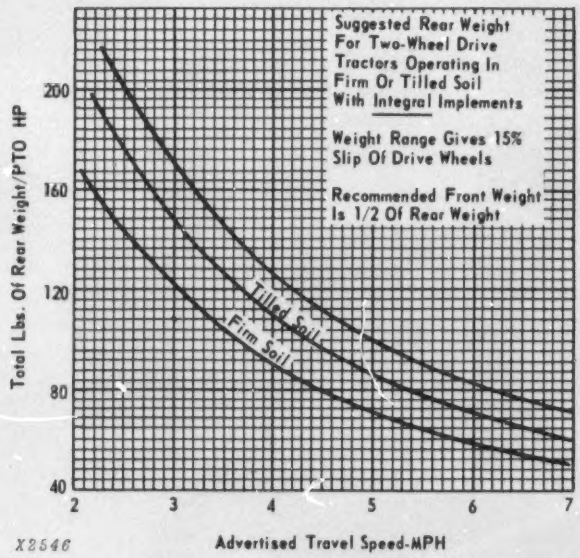

Fig. 16 — Tractor-Weight Guide For Integral Implements

SEMI-INTEGRAL IMPLEMENTS

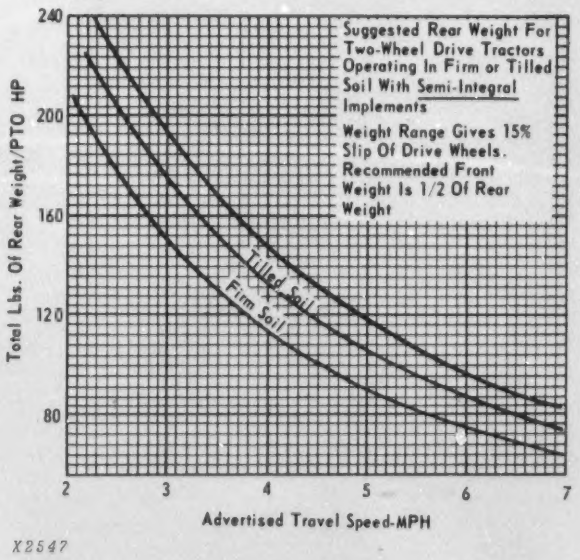

Fig. 17 — Tractor-Weight Guide For Semi-Integral Implements

Since the tables give the ballast in terms of total tractor rear weight, you need to know the actual rear weight of the tractor as a basis to start. Find the actual rear weight as follows:

1. Drive the tractor on a platform scale, leaving the rear wheels on the scale and the center of the tractor at the edge of the platform.

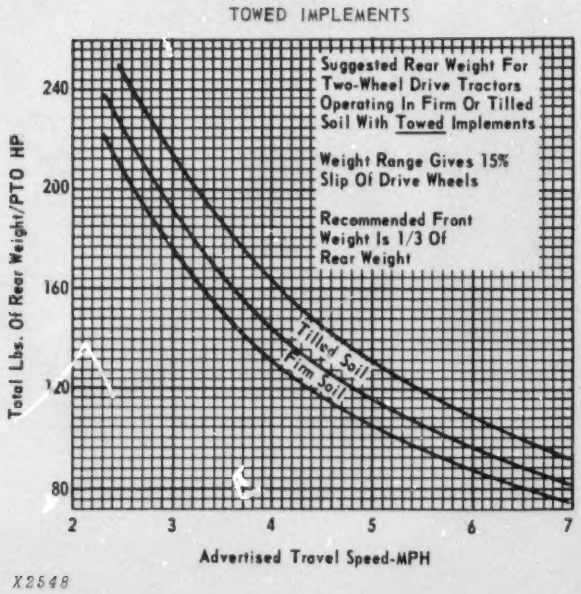

Fig. 18 — Tractor-Weight Guide For Towed Implements

2. Be sure the tractor is as level as possible, blocking under the front wheels if necessary.

3. Place the transmission shift lever in neutral.

4. Obtain the weight.

NOTE: The front end weight of the tractor can be found the same way, placing the front wheels on the scale.

The charts also tell the amount of recommended front tractor weight in relation to the rear tractor weight. As we said earlier, weighting the front of the tractor is a matter of stability and safety.

The following example explains the use of the Tractor Weight Guide.

Let's say a popular tractor is to be used with a semi-integral plow on a grass cover crop. The tractor is to be operated in 4th speed, which is 5.3 miles per hour.

In the Fig. 17 chart on "Semi-Integral Implements," find the lbs. rear weight/PTO hp range on *firm* soil at 5.3 mph. This is between 84 and 100 on the chart. If the tractor is to be operated at full load (120 PTO hp, for our example), the rear tractor weight should be between 10,100 and 12,000 lbs.:

120 PTO hp × 84 lb./rear PTO hp = 10,100 lbs.
120 PTO hp × 100 lb./rear PTO hp = 12,000 lbs.

However, if you want to operate the tractor at ¾ load (90 hp) the rear weight of the tractor should be within the range below:

90 × 84 = 7,550 lbs.
90 × 100 = 9,000 lbs.

If the middle of the firm soil range is used, the rear weights for full load and ¾ load operation would be about 11,000 and 8,300 lbs.

From these figures and the unballasted front weight, you can also calculate the amount of weight to be added to the front end.

CAST IRON AND LIQUID BALLAST

Ballast can be added as either liquid or cast iron (Fig. 19).

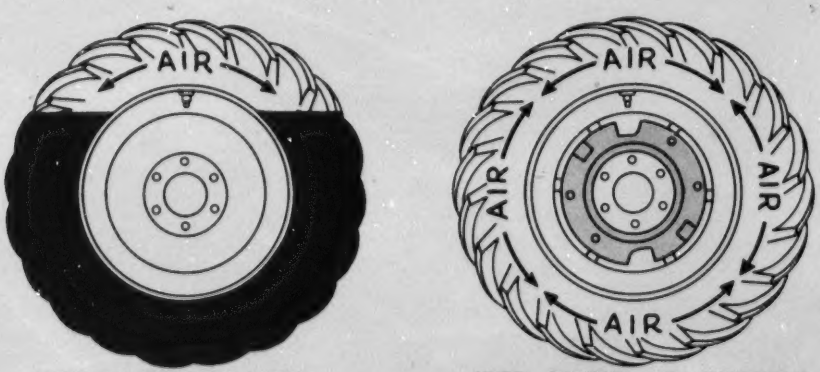

Fig. 19 — Liquid and Cast Iron Ballast On Drive Wheels

Cast Iron Weights

Cast iron weights for ballast can be obtained from the tractor manufacturer. Average wheel weights are 40-140 pounds, although heavier weights are often installed at the factories as original equipment.

General practice is to install liquid ballast in the tires and *then* add cast iron weights as required.

Liquid Ballast

Liquid ballast is usually water with calcium chloride added to prevent freezing where necessary. There are many methods of installing liquid ballast but a tire dealer normally has the equipment and does the work.

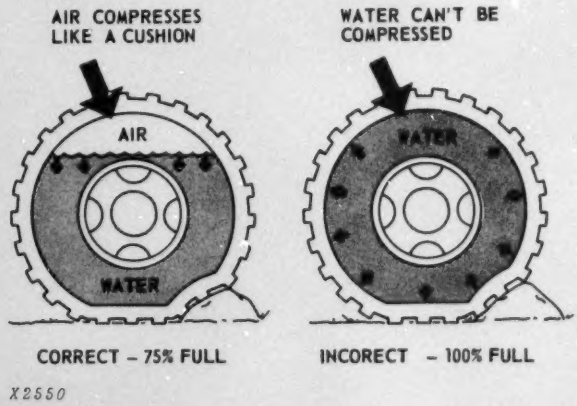

Fig. 20 — Why Tires Should Be Filled Only 75 Percent Full of Liquid Ballast

When installing liquid ballast in a tire, **normally fill only 75 percent or valve level** (Fig. 20). This is recommended for the following reasons:

1. An air chamber is needed to retain the pneumatic principle.

2. Water or liquid solutions cannot be compressed (the hydraulic principle). Thus, if the tire is filled 100 percent with liquid, it cannot absorb shocks and has little or no bruise resistance.

Normally, a 75 percent fill of liquid ballast does not add too much weight to be detrimental for light load operation.

Adding Liquid Ballast

To aid in ballasting a specific machine, the table on page 13 lists the MAXIMUM amount of liquid ballast possible for a given drive wheel tire. The maximum carrying capacity for two single tires is also listed. *Never exceed this carrying capacity.* For the actual recommended ballast to carry, always refer to the machine operator's manual.

Fig. 21 — Cast Iron Front End Weights On Farm Tractor

DRY BALLAST

Dry ballast is sometimes used for weighting tires. Some dealers are equipped to install dry ballast and a few manufacturers are installing dry ballast at the factory. Normally, tires are filled to 87-95 percent of capacity with the powder.

Advantages claimed with the use of dry ballast are:

1. Gives 20-30 percent more traction with less tire wear.

2. Reduces the inherent bounce in rubber tires, making for a smoother and easier machine to operate.

3. There is no freezing problem, as it is dry material and treated to resist moisture.

Dry ballast is furnished in three different weights: 10, 15, and 20 pounds per gallon. The 15-pound weight is recommended for 90-95 percent of all farm tractors, and the 20-pound weight for heavier equipment.

There are some **disadvantages** in dry ballast:

1. Higher initial cost than other types.

2. Requires outside servicing with special equipment.

3. Loss of ballast in case of tire and tube or valve failure.

In summary, dry ballast has shown its potential and some manufacturers now recommend it for use with their equipment.

LIQUID BALLAST CHART

Tire Size (Drive Wheels)	Ply Rating	Max. Carrying Capacity (Lbs.)*	Gallons Liquid	Pounds Liquid Including $CaCl_2$**
13.6 - 28	4	4860	74	878
13.6 - 38	6	6940	98	1162
14.9 - 28	6	6640	92	1090
15.5 - 38	6	7320	112	1326
15.5 - 38	8	8660	112	1326
16.9 - 34	6	8340	140	1658
16.9 - 34	8	10040	140	1658
16.9 - 38	8	10640	154	1824
18.4 - 34	6	9880	170	2014
18.4 - 34	8	11300	170	2014
18.4 - 38	8	11940	188	2226
18.4 - 38	10	13900	188	2226
20.8 - 38	10	15300	240	2842
24.5 - 32	10	17800	292	3458

**Capacity values are for TWO single drive wheel tires.*

***Liquid ballast weight is based on water with 3½ lb of calcium chloride ($CaCl_2$) per gallon and tires filled to valve level (75 percent full). (This mixture protects against freezing (slush-free) to –12°F.)*

DUAL TIRES

As the engine horsepower in a rubber-tired tractor is increased, traction problems also increase. The use of dual tires (Fig. 22) is one way to add more carrying capacity. This in turn allows more weight to be applied through the use of ballast (liquid, dry, or metal), resulting in greater traction.

ADVANTAGES OF DUAL TIRES

1. Dual tires, with added ballast, give you more ground contact. Result: Less slippage, increased ground speed, improved work rates, and possibly reduced fuel consumption.

2. Improved tractor stability is a recognized "plus" because of the increase in width provided by dual tires.

3. Dual tires lessen driver fatigue by providing a smoother ride during operation.

4. The use of dual tires to replace single tires of the same size gives more flotation, and helps keep the tractor on top of the ground.

5. Tractors which can be converted to duals have a higher potential for all-season use. Duals can be used to meet the high horsepower requirements for land preparation while single-tired machines can be used for row crop, tillage, and haying operation.

6. Duals permit use of the tractor under many adverse weather and soil conditions not feasible when using singles. Result: On the farm, plowing and disking can start earlier in the spring.

7. Duals permit a tractor with one tire requiring service to be moved to a more convenient area, thus reducing downtime.

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Fig. 22 — Dual Tires

DISADVANTAGES OF DUAL TIRES

1. Some tractor axles, bearings, and power trains may be overstressed by dual wheels. Always consult your local tractor and implement dealer for advice before installing duals.

2. Reducing the air pressure in dual tires for riding comfort may affect tire life by causing overdeflection of the tires. Consult the operator's manual or the local tire dealer for recommended air pressures.

3. If the drawbar load is fairly light, there is no real advantage in dual tires over single tires of the same size, other than riding comfort, better stability, and reducing of soil compaction.

4. Dual tires may make a tractor more difficult to turn and, if short turns are made, the extreme stress on the tread lugs may cause the lugs to tear.

5. Changing a large dual tire may be difficult unless you have the proper equipment. Specialized equipment for changing of large farm rear tires is most readily available through farm tire dealers.

MATCHING OF DUAL TIRES

Mismatched tires on duals cause uneven distribution of the load, which makes the larger tire carry too much load and wear faster. To avoid this, tires of approximately the same diameters or overall height should be matched on dual wheels.

On dual wheels, there should not be a differential of more than ¼ inch in diameter or ¾ inch in circumference on 8.25 or smaller tires . . . and not more than ½ inch in diameter or 1½ inches in circumference on sizes larger than 8.25. The most accurate check is to take a circumferential measurement with a steel tape on tires mounted and inflated.

Tandem drive machines should have matched tires on all drive wheels. Failure to keep tires uniform in size will result in excessive slippage and fast wear of the odd-sized tires. It may also cause axle breakage, difficult steering, and other problems.

How To Check Sizes of Dual Tires When Mounted On Machine

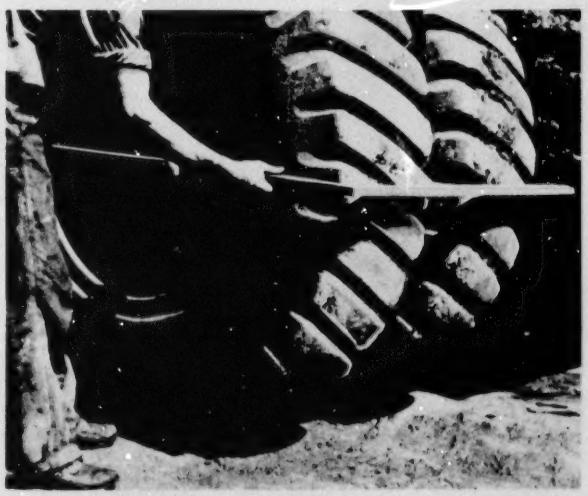

Fig. 23 — Checking Sizes of Dual Tires With a Square

Method No. 1 is to use a right-angled square made of 1 x 2-inch wood strips to measure the diameter differential of dual tires (Fig. 23). In construction, this measuring or checking unit should be squared with a carpenter's steel square and rigidly fastened to maintain a true 90° angle. If one tire is too small, it becomes apparent at once as the wood strip is laid across the tires.

Method No. 2 uses a cord (Fig. 24) as a quick and easy way of checking duals. This device can be easily improvised using two rubber bands cut from old tubes, two hooks made from welding rod, and a length of ⅛ inch cord. By hooking on to a wheel stud or valve, the cord quickly shows if the inside tire is smaller. If the cord touches both tires, any difference in diameter can be determined by slowly lifting the cord from the outside tire until it is just touching the inside tire.

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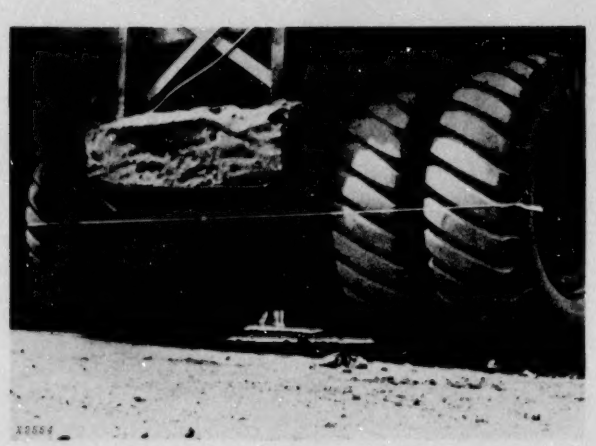

Fig. 24 — Checking Sizes of Dual Tires With a Cord

OPTIONS IN PLACE OF DUAL TIRES

There are many other types of tires produced for off-the-road service. Some of these are made extra wide to be used in place of dual tires. Others come as standard equipment on earthmoving machines and the like. Still others are installed to replace dual tires.

Before replacing duals with these tires or vice versa, consider these factors:

1. **Load-carrying capacity**
2. **Adaptability to the machine**
3. **Cost**

As a rule, the manufacturer of the machine installs tire equipment which is most practical and safe for his product. He is as much interested as you that the machine gives the best service for the longest period and for the least money.

FRONT TRACTOR TIRES AND IMPLEMENT TIRES

Like rear drive tires, front tractor and implement tires have a large variety of treads, sizes, and ply ratings. Some, which are used to provide power to lift a plow out of the ground or drive some component on the machine, have cleats similar to tractor drive tires. However, most front tires are used for steering and have ribbed treads. This also helps to prevent skidding.

SWITCHING TIRE TYPES AND SIZES

Replacement tires generally should be the same type, size, and play rating as those installed as original equipment.

In some cases, such as unusually severe service or special traction or flotation requirements, a different size, different type, or stronger tire might be considered, as recommended by the farm equipment manufacturer.

Always bear in mind that a tire with low initial cost is not necessarily the least expensive in the long run. The tire that will deliver maximum performance over a longer period of time frequently costs less when you calculate on a basis of cost-per-hour of operation or work performed in similar service.

The performance of the tire being replaced, service conditions, terrain, loads, and dimensional limitations all must be considered. Reference data which permits proper matching of tire to vehicle and type of service is an everyday tool of any reputable tire dealer.

It is recommended that you consult such a tire dealer for his professional advice when selecting replacement tires.

TIRE FAILURES

In this section we will cover the common tire failures and their causes. In the next section on "Tire Repairs" we will tell how to repair these tire failures.

FABRIC BREAKS

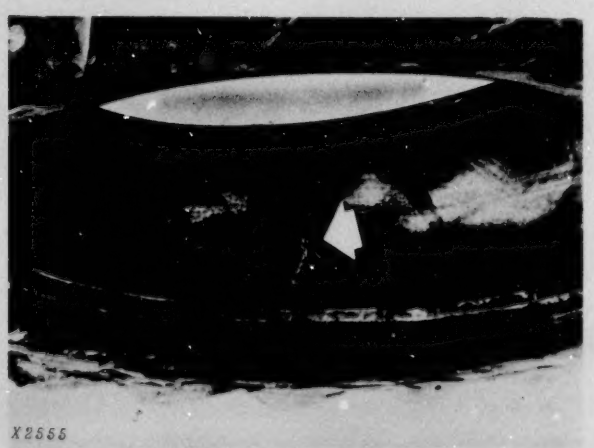

Fig. 25 — This Small Fabric Break Can Be Repaired and The Tire Kept For Its Full Service Life. It Is Typical of The Average Small Break In a Rear Tractor Tire.

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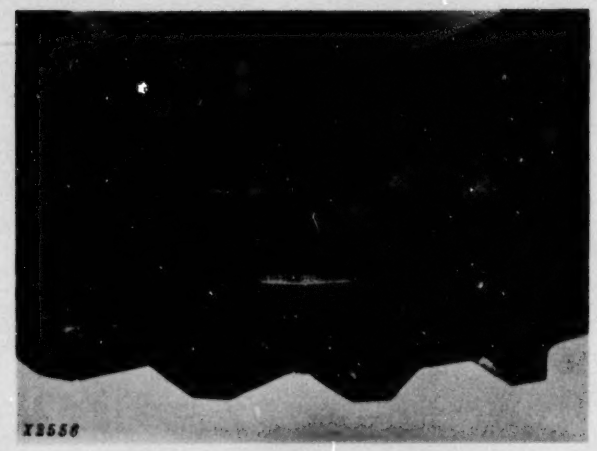

Fig. 26 — This Break Was Caused By Tire Hitting Some Object. The Fabric Was Unable To Withstand The Shock.

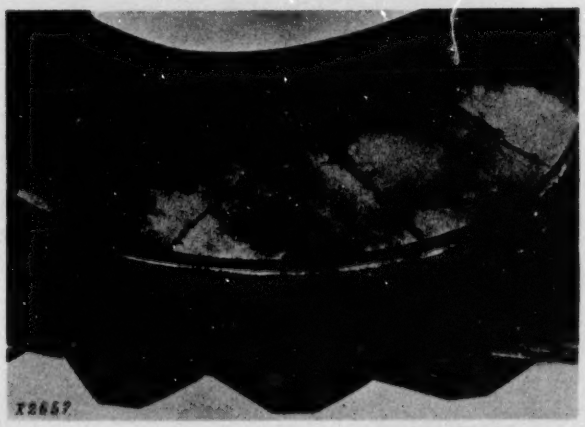

Fig. 27 — A Severe Rupture of The Cords Which Extends From Bead to Bead. This Was Caused By An Impact At Too-High Speed Or With The Tire Overinflated.

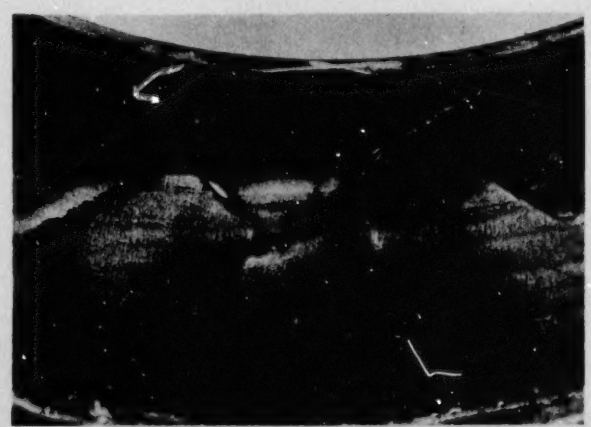

Fig. 28 — Freezing Ruined This Tire. Filled With Water, It Was Broken When The Water Froze And Expanded. Antifreeze Solution Would Have Prevented This.

Most fabric breaks are caused by hitting some object, which puts too much shock on the fabric (Figs. 26 and 27).

The force is greater if the impact occurs at high speed, or if the tires are overinflated (Fig. 27). At high inflation pressures, injuries may occur which later result in a large "X" or diagonal break which may extend from bead to bead.

Even at correct tire inflation, a severe localized blow, such as contact with a sharp rock or tree stump, can produce a severe penetrating force which may result in cord breakage like those shown.

To reduce the hazard of tire breaks, use extra ply tires, correct tire inflation, and extra care in driving.

A special kind of tire break is caused by water freezing and expanding in the tire (Fig. 28). To prevent this, always use an antifreeze solution as liquid ballast in your tires.

Fabric Breaks On Furrow Tires (Farm Tractors)

On farm tractors, the furrow tire may be distorted by the tilt of the tractor. This puts a severe folding action on the tire, especially if the inflation is too low.

The inner sidewall of the tire may buckle and fold until the cords finally separate and a series of breaks appear on the inside of the sidewall (Fig. 29).

This action may also cause a series of cracks at the edge of the tread bars (Fig. 30). Sometimes the cracks may extend into the sidewall as shown.

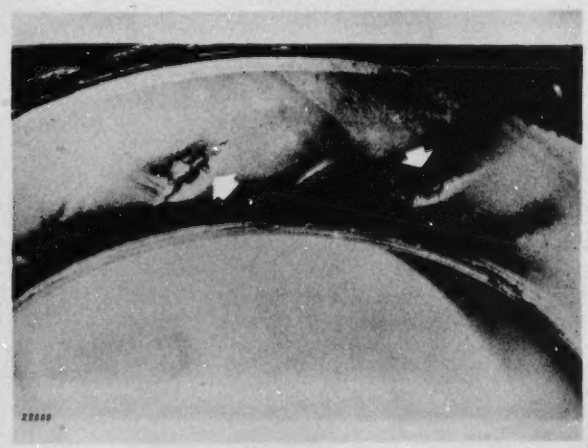

Fig. 29 — Furrow Tire On Farm Tractor Which Has Low-Pressure Buckle or Furrow Break

Fig. 30 — Furrow Tire Which Has Sidewall Cracking Due To Underinflation and Heavy Drawbar Load

To help prevent stress on the furrow tire, make these adjustments:

1. Place 4 pounds more pressure in the furrow tire than in the land tire — providing the maximum recommended pressure is not exceeded.

2. Adjust the plow hitch laterally so that the furrow tire does not need to crowd the furrow wall to plow a full-width cut.

RUBBER CHECKS

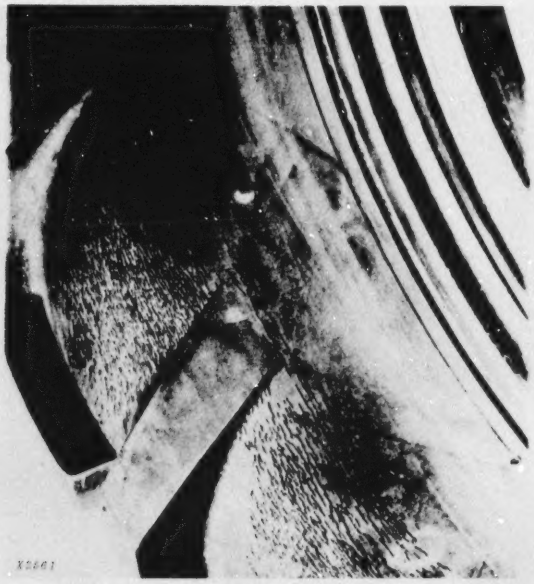

Fig. 31 — Weather Checks On The Tire Are Not Usually Harmful

Small checks or cracks may develop on the rubber sidewall (Fig. 31). These are usually caused by tires inflated to high pressures and those exposed to sunlight, ozone, air drafts, or electrical discharges.

Normally this is an appearance condition only and will not affect the service life of the tires. Correct pressure and protection from the elements will help prevent this condition. Even a good coating of mud on the tires may be helpful.

WEAR FROM SPINNING WHEELS

Fig. 32 — Spinning Wear

Tractor tires with too few wheel weights or too much inflation will wear the tread bars rough, or will snag and cut the bars, when subjected to severe service on abrasive surfaces. Sudden engagement of the clutch in starting also causes this type of tread wear. Tread bars are cut and worn on the leading or forward edge (Fig. 32).

To prevent spinning wear, add wheel weights, reduce inflation to normal for conditions, reduce the draft load where possible, and engage the clutch slowly when starting.

STUBBLE WEAR

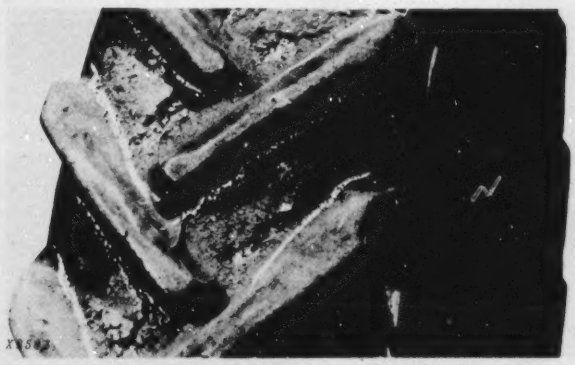

Fig. 33 — Stubble Wear (Farm Tractors)

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Stubble wear on the tread rubber is caused by operating a tractor tire over corn stubble (Fig. 33). Stubble can be so rigid as to puncture the tire. To avoid or limit stubble damage, adjust the track width of the rear tires so neither tire rides over the stubble — and avoid spinning the wheels where they do contact the stubble.

HARD ROAD OPERATION

Tractor tires operate most of the time in field conditions where the soil can conform more or less to the tread design, and where all portions of the tread make contact with the soil. In operating on hard roads with low inflation pressure there is an undesirable distortion of the tire during which the tread bars squirm while going under and coming out from under the load.

Fig. 34 — Tread Wiping From Operation On Hard Surfaces

On highly abrasive or hard surfaces, this action wipes off the rubber of the tread bars or lugs and wears them down prematurely and irregularly (Fig. 34).

If tires are to be operated for any length of time on roads or other hard surfaces and the draft load is not great, *increase the pressure in the tires to the maximum recommended* in order to reduce movement of the tread bars which causes excessive wiping action. Under these conditions wear in the center of the tread can be expected.

Farm tractor and implement tires are designed for low-speed operations not exceeding 20 miles per hour. If tractors and implements are towed at high speeds on the highway, heat may develop under the tread bars which weaken the cord material and cord fabric. This may not be visible at the time but may result in a premature failure later.

VALVE DAMAGE

When valves are torn off tubes, it indicates a slippage of the tire bead on the rim or improper centering of the valve in the hole of the rim.
Slippage of the tire bead on the rim may be caused by:

1. *Low inflation pressure.*
2. *Improper seating of the bead on the rim.*
3. *Excessive use of soap solution on bead or rim when mounting the tire.*

When the valve slips, the tire should be demounted and the rims and wheels carefully cleaned. Then the tire and tube should be mounted and inflated, deflated, and then reinflated as described under "Mounting Tube-Type Tires" in a later section.

TREAD AND SIDEWALL CUTS

Most tires injured by cuts or snags (Figs. 35 and 36) can be repaired and continued in service. Inspect tires periodically for possible injuries. Cuts or breaks that enter into or expose the cords in the body of the tire should be promptly repaired. If this is not done, moisture and foreign material will enter the injury, deteriorate the cords, and make it impossible to restore the tire to service (Fig. 35, right).

A tire injured in this way should be removed promptly from the wheel and sent to a reputable tire service station or repair shop where a permanent repair can be vulcanized into the tire. If, in an emergency, it is necessary to continue to use the tire after it has been injured, a blowout patch or boot can be inserted at the point of injury to reinforce it. Never use a temporary repair any longer than three or four days; then remove the tire and have it repaired by a competent tire serviceman.

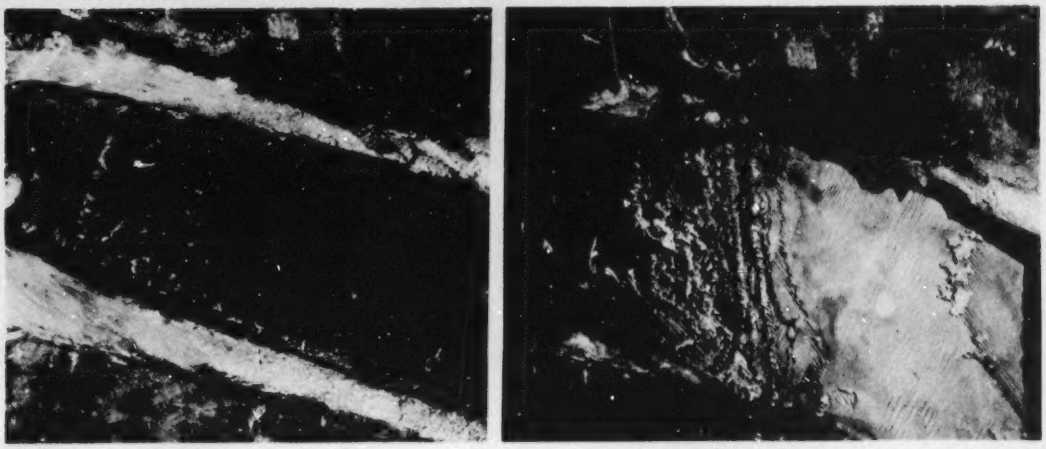


Fig. 35 — Prompt Repair Of This Cut At Left Would Have Prevented The Damage At Right

When a cut or snag extends only into a rubber lug and not into the tire cords (Fig. 36) it should be treated by bevelling out any loose piece of rubber with a knife to prevent extension of the tear or cut so it will not pick up stones or other matter which may work its way into the cords. This cut should be made as smoothly as possible by bevelling out the sides of the injury from the bottom to the surface of the lug as shown. Always consult your tire serviceman as soon as possible.

Repair of tires is given in detail in the next section on "Tire Repairs."

GREASE AND OIL DAMAGE

Do not allow tires to come in contact with grease or oil, as both destroy rubber. After using a machine for spraying, wash off any chemicals that may have dropped on the tires.

While the tread and sidewall rubber of off-the-road tires is compounded to resist sunlight, always keep the machine under cover and jacked up when not in use over a long period. Only when it is put back into service should the tires be inflated to correct pressure.

BELT WORK

When a rubber-tired machine is operated on belt work, static electricity may be developed. If the machine is not grounded, this may be damaging to the tires. Ground the machine by having a chain, wire, or rod connecting the metal frame to the ground.

TIRE OBSTRUCTIONS

The frame of the machine or a fender or other part may become bent or misaligned and rub on the tires. Sharp corners can even gouge the tire each time it turns. Check periodically for these tire obstructions.

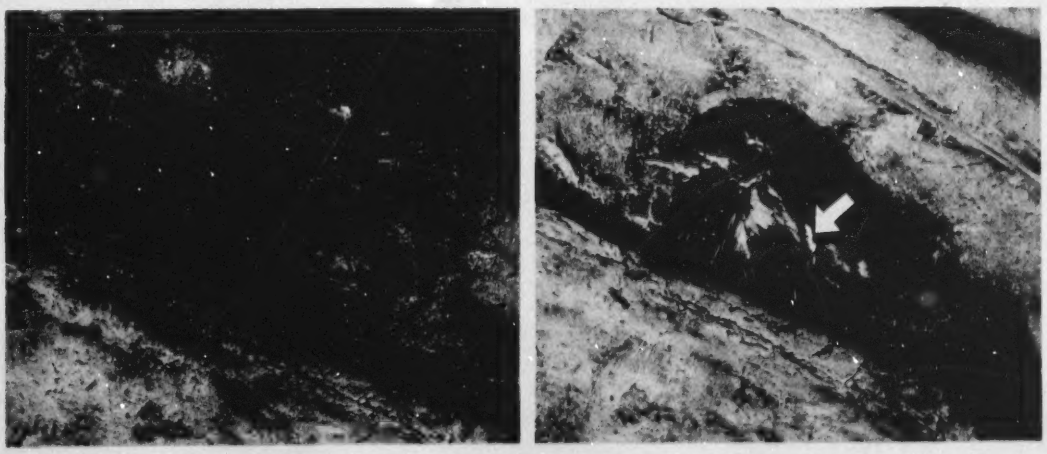


Fig. 36 — Small Cut In Tire Lug (Left) Should Be Bevelled Out To Prevent Imbedded Stones (Right)

TIRE REPAIRS

Both tube-type and tubeless tires can be repaired in much the same way. If tire injuries are detected early, they can usually be repaird before a blowout or other failure occurs.

FLAT TIRES

If a tire loses all or most of its air pressure, particularly when driving at high speeds, it must be removed from the wheel for complete internal inspection to be sure it is not damaged. Inspections have shown that as many as 2 out of 3 tires, run even a short distance while flat, are damaged beyond repair (Fig. 37).

Punctures, nail holes, or cuts up to ¼ inch can be repaired permanently only from the inside of the tire. Consult your tire supplier for information on larger repairs.

Fig. 37 — This Tire Was Driven Only A Short Distance While Flat. It Cannot Be Repaired

TEMPORARY REPAIR OF TIRES

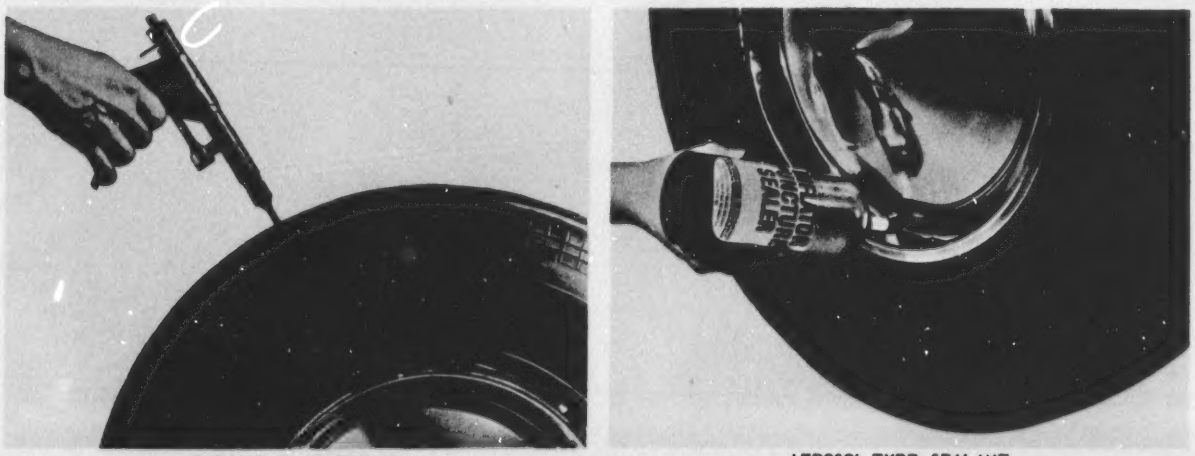
Temporary repairs, such as "blowout" patches or any outside tire repair, should not be made except in case of emergencies (Fig. 38). Emergency repairs, such as outside plugs or aerosol-type sealants are only good for a short time, and then only at low speeds. If these temporary repairs are used, make a permanent vulcanized repair with a plug and patch applied from the inside of the tire as soon as possible. In emergencies, a good spare tire, properly inflated, is the best insurance.

IMPORTANT: For radial ply tires, repairs can only be made in the central tread area, between the major outside grooves.

PERMANENT REPAIR OF TIRE PUNCTURES

1. After removing the tire from the rim, probe the injury to remove nails or other damaging material. Make sure that the area around the injury is thoroughly dry. Scrape the damaged area with a sharp-edged tool and buff (Step 1, Fig. 39). Be careful not to damage the liner or expose any cords.

2. Lubricate the injury by pushing the snout of the vulcanizing fluid can into the injury from both sides of the tire (Step 2, Fig. 39). Also pour vulcanizing fluid on the insertion tool and push it through with a twisting motion until it can be inserted and withdrawn easily.



X2568 OUTSIDE PLUG REPAIR AEROSOL-TYPE SEALANT

Fig. 38 — Temporary Repairs of Smaller Tires (Only For Emergencies)

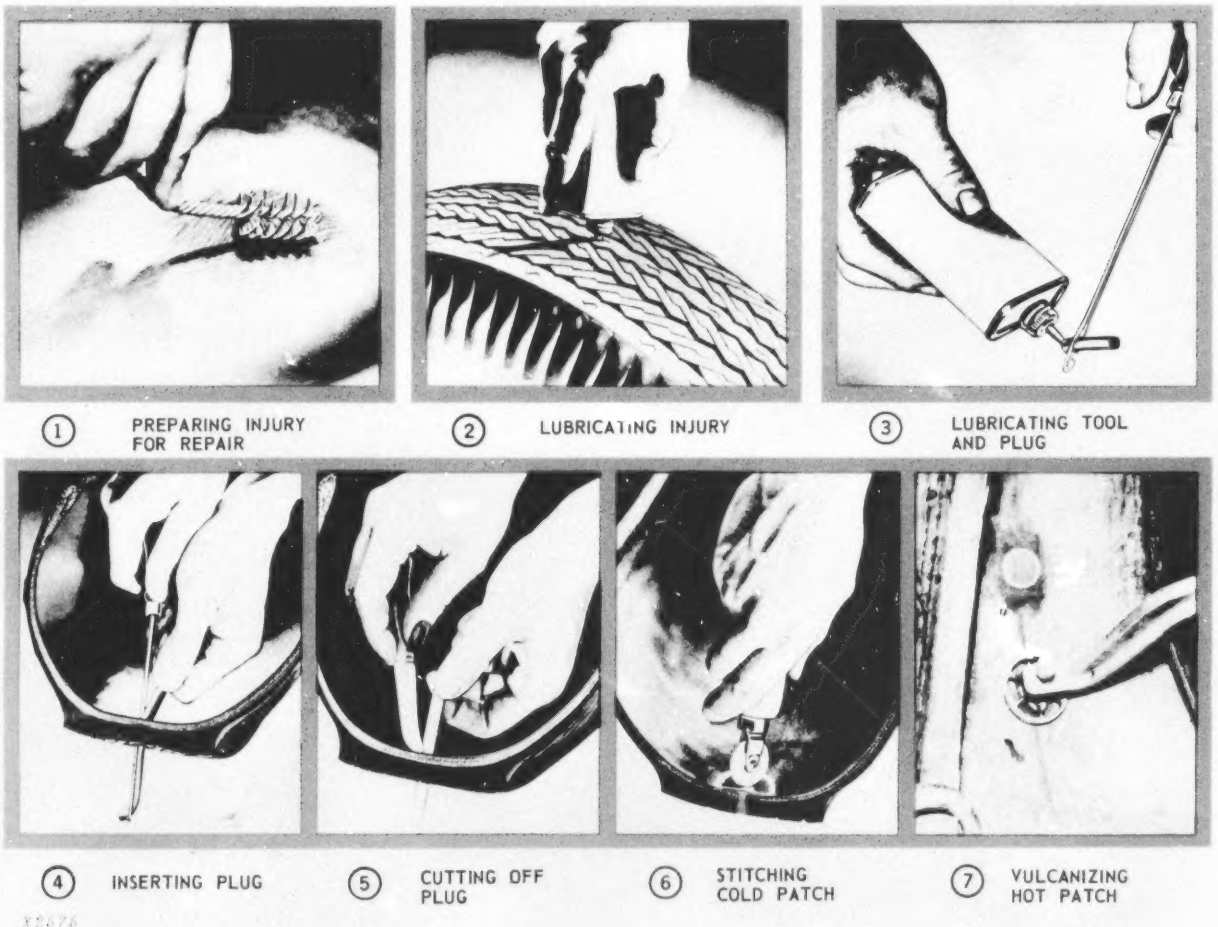


Fig. 39—Permanent Repair Of Tire Punctures

3. Using a head type or headless straight plug slightly larger than the size of the injury, place it in the eye of the insertion tool. When a headless straight plug is used, always back it up with a patch. Wet both the plug and insertion tool with vulcanizing fluid. Always pour directly from the can so as not to contaminate the can's contents (Fig. 39).

4. While holding and stretching the long end of the plug, insert plug into injury from the inside of the tire. Hold and stretch the long end of the plug as it is forced into the injury until one end extends through it. (Fig. 39).

5. Remove insertion tool and cut off plug 1/16 inch above the surface(s) (Fig. 39). Do not pull on plug while cutting it. Never wash previously prepared surface with solvent prior to application of vulcanizing fluid.

6. When using cold patch, carefully remove backing from the patch. Center patch base on damaged area over which vulcanizing fluid has been spread and allowed to dry. Stitch patch down firmly with stitching tool (Fig. 39), working from the center out.

7. When using a hot patch, cover buffed area with a light coat of cement of the type specified for the patch and allow to dry. Remove backing from the patch. Center patch over injury (Fig. 39). Clamp it — finger tight only — apply heat, cure and allow to cool. Before remounting tire, clean and de-burr rim carefully.

NOTE: While these instructions are easy to follow, tire repairs should normally be done by a competent tire serviceman.

Repairs to tire tubes can be made with cold patches, but hot patches are always more satisfactory.

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Tubeless tires can be repaired in the same manner as tube-type tires. Injuries which may lead to blowouts in tube-type tires are detected early in tubeless tires and can be repaired before extensive and costly damage results (see Fig. 35).

Even with the best of maintenance, cuts will still be a source of tire trouble.

Always use the correct procedure for handling and repairing tires. Closely inspect all tires at the time of inflation checks, and repair all tires having cuts that penetrate into the cord body.

Failure to make regular inspections and repairs when needed will result in further deterioration of the cord body and eventually a blowout.

Fig. 40 — Cut Around Small Tire Cuts To Prevent Imbedded Stones

Small rocks and dirt may get into cuts in the tread and, if neglected, will eventually be pounded into the cord body. One simple method of preventing this is to clean out the cut with an awl or similar tool to remove stones or any other matter which may be lodged in the cut. Use a sharp, narrow-bladed knife to cut away the rubber around the cut to form a cone shape extending to the bottom of the cavity (Fig. 40).

The sides of the cavity should be slanted enough to prevent stones from wedging into it. Tires with cuts treated in this way may be kept in service without danger of further growth of these injuries.

If the tire has at least one cut that requires a repair, then all smaller cuts can be quickly and economically repaired and vulcanized.

Large carcass breaks over one-third the width of the tire cannot be economically repaired.

When the injury is repairable, then the anticipated life of the tire must be compared to the cost of the repair work. The older the tire, the less service is received from repairs.

SIMSCREW REPAIR OF TIRES

This is a new repair method, developed by one of the leading tire manufacturers. Neothane lag screws are frozen to make them stiff enough to be screwed into punctures in tubeless truck and earthmover tires. When thawed out, the screw becomes flexible, works with the tire, and seals the puncture. Two types are available: "Freeze-type" makes the best repair and is the most popular type. The "no-freeze" type is considered more of a temporary repair. For more information, consult your tire supplier.

RECAPPING TIRES

NOTE: Tubeless tires can be recapped in the same way as tube-type tires.

Recapped tubeless tires **do not** require the installation of a tube when put back into service if the tire beads and inner liner are in good condition.

In some off-the-road operations, such as soft dirt excavation and hauling, recapping pays big dividends.

The deciding factor is the severity of the job the tire must do. Tires on free-rolling wheels of scrapers, all grader tires, farm implement tires, etc., generally are recappable.

Some industrial jobs are too tough for recapped tires: High speed and overload operations and abnormally long service at low inflations all take too much life out of the cord body to expect it to stand up under the strain of more than one tread. An exception is the case of fast tread wear from steep grades and abrasive surfaces. Where these conditions exist, recapping is highly profitable.

On large industrial tires with wire in the body, a recapping program can be carried out. Modern recappers can recap wire and will replace the wire if necessary.

STORING AND HANDLING TIRES

Tires and tubes can deteriorate unless they are stored carefully. It is also important to handle them with care to prevent damage.

STORING AND HANDLING TUBELESS TIRES

Store and ship unmounted tires in a vertical position. Horizontal storing may compress the beads and make inflation difficult.

Do not lift tires by beads with hooks or forks. Sharp hooks or forks may tear, cut, or snag the tubleless tire beads and result in leaks.
Remove all foreign matter or moisture from the inside of the tire.

Tubeless tire rims perform an important function as a part of the assembly air seal. For this reason, be careful not to distort or mutilate the rim parts. Always check the O-ring groove for burrs, rust, and excess paint. Never lift the rim by the valve hole. Never drop, tumble, or roll rim parts.

Use babbit or lead hammers, not sledge hammers, when assembling rims.

Store O-ring seals carefully in a cool, dry place where they will not be injured or damaged.
Store valves in a cool, dry and clean place.

STORING TUBE-TYPE TIRES

Tires and tubes can rapidly deteriorate under certain conditions. They must be stored with extra care. Limit storage time by using tires in the same order as they are received.

Factors which cause deterioration in storage are: light, heat, air, drafts, ozone, oils, dust and dirt, and water inside the tires.

The following procedures are recommended for tire storage whether for prolonged periods or for a relatively short time.

Storing New Tires

1. Store new tires indoors in a cool, dark, dry area, free from drafts. If indoor storage is impractical, tires can be stored outdoors, providing they are covered with tarpaulins or other opaque waterproof covering. Water and moisture must be kept from inside the tires. This can best be done by mounting on wheels, inflating to 50 percent of operating pressure, then covering with tarpaulins.

2. Store tires away from electrical devices such as motors, or switches, since they are an active source of ozone.

3. Do not store tires in the same or adjoining rooms with gasoline and lubricants. The solids, fluids, or vapors from them are readily absorbed by rubber and cause rapid deterioration.

4. Tubeless tires should not be stacked but should be stored in a vertical position, on the tread. Stacking will tend to deform the tire and force its beads together and produce strains in the rubber which will accelerate weather damage. This can make inflation difficult. New tubeless tires are banded to prevent bead deformity. Do not remove the bands prior to mounting.

Storing Used Tires

1. Clean and carefully inspect used tires before storing. Make all necessary repairs before storing, especially if the cord fabric is exposed, as moisture will be absorbed readily.

2. Observe same storage conditions and precautions as for new tires (above).

Storing Mounted Tires

1. If tires must be stored while mounted on the vehicle, block up so weight does not rest on the tires, and release the air from the tires. When the vehicle cannot be blocked, check air pressure frequently and maintain the FULL inflation.

2. Vehicles on tires should be moved occasionally so the same section of the tire is not always under strain from deflection.

3. Protect each tire by a cover or wrapping of canvas or similar material.

4. *Never* use paint to preserve tires. If exposure is severe, consult your tire supplier for recommendations.

Storing Tubes

1. New tubes should be left in original packages. Store in a dry, cool, draft-free storage area.

2. Used tubes should be removed from the tire, completely deflated, cleaned, folded and stored in the same manner as new tubes.

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TIRE MOUNTING AND DEMOUNTING

We will cover mounting and demounting for these types of tires (the Roman numerals identify the procedures for each type):

I — Small Tires for Implements and Trucks

II — Large Tires for Implements and Trucks

III — Tractor and Machine Drive Wheel Tires

IV — Large Tires for Off-The-Road, Industrial Equipment

CAUTION: Failure to follow proper procedures when mounting a tire on a wheel or rim can produce an explosion which may result in serious injury or death. Do not attempt to mount a tire unless you have the proper equipment and expertise to perform the job.

When seating tire beads on rims or wheels, never exceed maximum inflation pressures specified by tire manufacturers for mounting tires. Inflation beyond this maximum pressure may break the bead, or even the rim, with dangerous explosive force.

- **Various tire sizes and designs may have different maximum inflation pressure limitations for safety. Know what these maximum pressures are before attempting to inflate a tire.**

SAFETY TIPS FOR INFLATING AND MOUNTING TIRES

The following safety guidelines are general recommendations. Different designs of tires and rims may require specific safety practices for inflating and mounting procedures.

If you don't follow proper procedures when inflating or mounting a tire you may be seriously injured or killed.

- **Unless you have the proper tools and experience, it is unsafe to attempt to inflate or mount tires. Have a tire service station repair it.**
- **Follow machine manufacturer's recommendation for removing tire and wheel or rim assemblies.**
- **Regardless of how firm the ground appears, place sound wood blocks under the jack. Don't use masonry blocks or bricks because they could fracture under load.**
- **Handle tire and wheel or rim assemblies carefully. Some assemblies are heavy and can crush your arms or legs if the tire and wheel were to fall on them.**
- **When inflating tires, use a clip-on chuck and extension hose long enough to allow you to stand to one side and NOT in front of or over the tire assembly (see Fig. 41).**

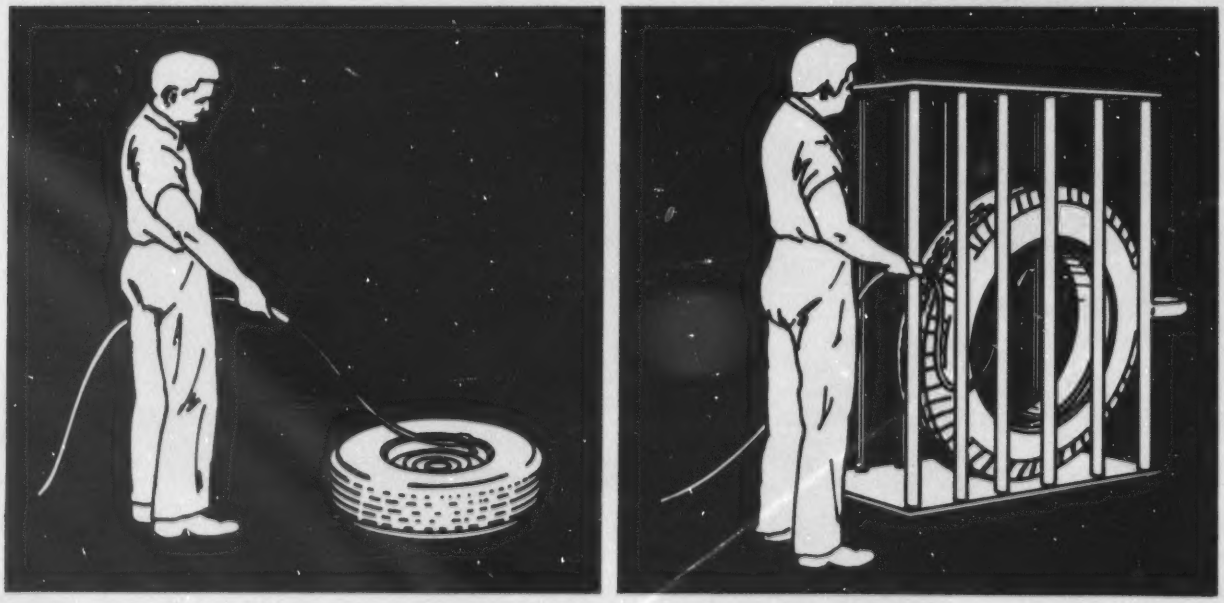
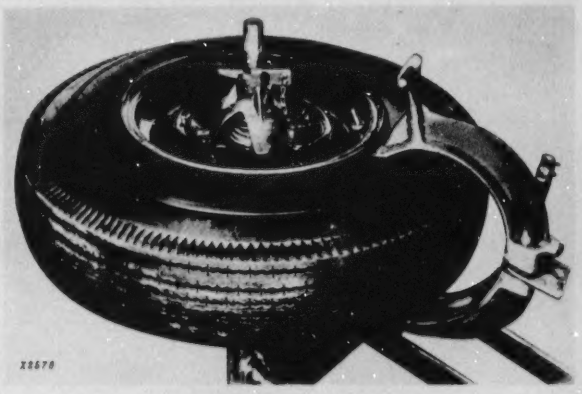


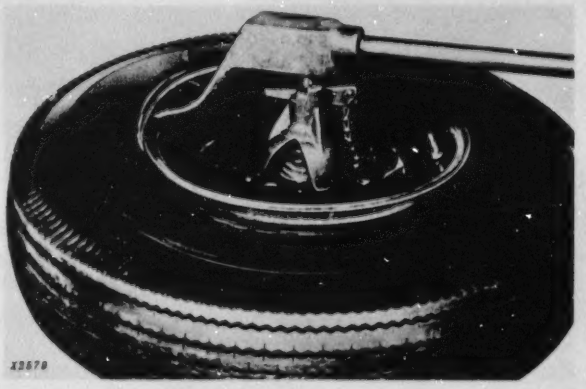
Fig. 41 — Use A Clip-On Chuck Hose Extension When Inflating Tires

I — DEMOUNTING SMALL TIRES FOR IMPLEMENTS AND TRUCKS

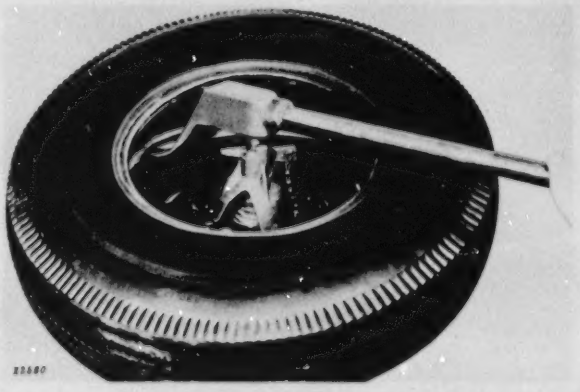
With Tire Mounting Machine



1. Remove valve core and completely deflate tire. Apply lubricant at top of rim flange. Loosen both tire beads from rim flanges with bead breaker tool. Caution . . . do not use a hammer or tire iron to loosen beads. Do not damage any portion of beads.



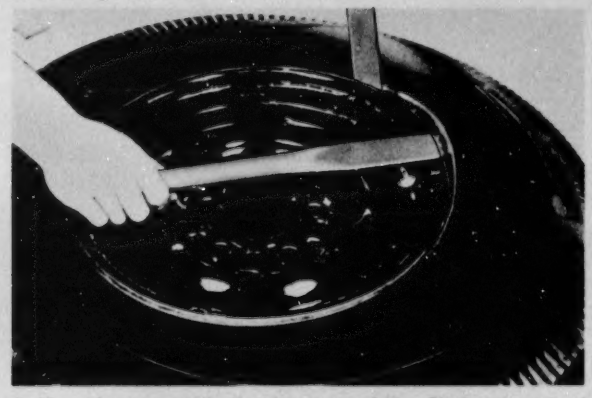
2. Next, press side of tire into rim well and remove first bead in regular manner. (On tube-type tires, remove the inner tube — carefully.)



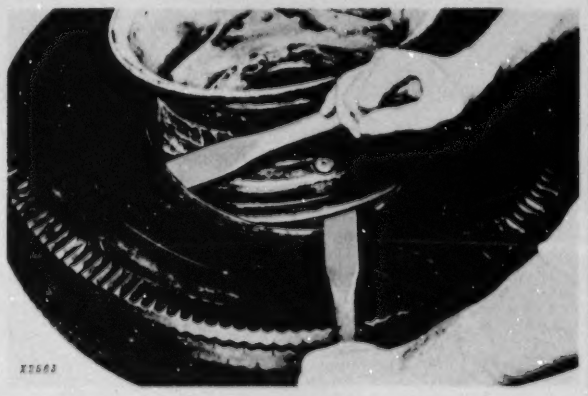
3. Remove the lower bead. Then remove the tire from the rim.

Without Tire Mounting Machine

1. Remove valve cord and completely deflate tire. Apply lubricant at top of rim flange. If tire bead cannot be forced away by foot pressure, use any commercial-type bead breaker tool. Do not use hammer or tire irons to loosen beads. Do not damage the beads.



2. Use clean, smooth tire irons carefully. Start removal of outside bead at valve, taking small bites with irons around rim. Do not damage the bead area. (On tube-type tires, remove the inner tube — carefully.)



3. Turn tire over and use two irons — one between rim flange and tire bead to pry rim upward and the other iron to pry outward between bead seat and tire bead. Start removal at valve to eliminate any possibility of bead catching on valve base.

Fig. 42 — Demounting Small Tires For Implements And Trucks

- **Before mounting a tire, lubricate the tire bead when recommended. This will allow easier seating of the bead and reduce the pressure necessary to seat it.**
- **When using bead breakers and tire tools, keep your fingers and feet clear of pinch points to avoid injury.**
- **Keep a firm hold on tire irons or other tools. In some cases if a tool slips from your control, it could be thrown with enough force to cause serious injury.**

The following procedures for mounting and dismounting tires are intended only to familiarize you with proper methods, not to make you an expert. Do not attempt to dismount or mount tires without training by an experienced person who is familiar with the proper methods and tools.

I — CHANGING SMALL TIRES FOR IMPLEMENTS AND TRUCKS

TOOLS

Unless you have a tire mounting machine, you will need a proper set of tire tools. It is very easy to damage the tubeless tire beads or the inner tube when changing tires unless you have the proper tools.

DEMOUNTING TIRES WITH TIRE MOUNTING MACHINE

Refer to Fig. 42 (left column) for instructions on demounting tires if you have a tire mounting machine.

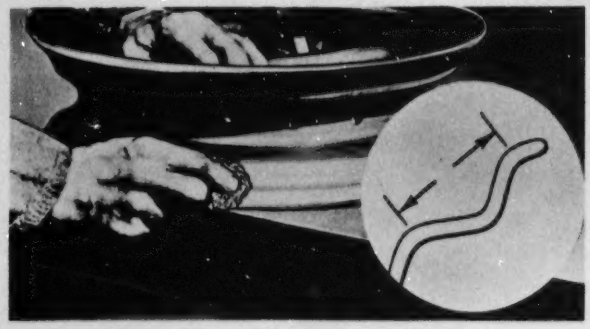
DEMOUNTING TIRES WITHOUT TIRE MOUNTING MACHINE

Fig. 42 (right column) has instructions on demounting tires if you do *not* have a tire mounting machine.

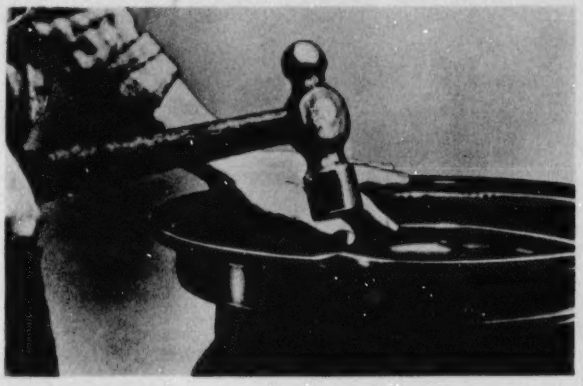
Fig. 43 — Preparing Rim Before Mounting (Tubeless Tires)

PREPARING RIM BEFORE MOUNTING (TUBELESS TIRES)

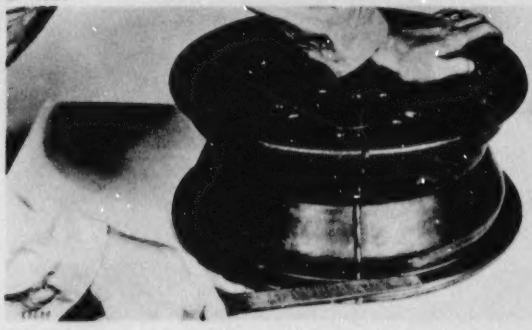
Because the rim must be leakproof in a tubeless tire, the following steps must be taken **before** the tire is mounted to be sure the rim will not leak.



1. Rim flange and bead seats must be clean. Remove all foreign material with emery cloth or coarse steel wool. Rust can be removed with a wire brush. (Circle shows area which must be clean.)



2. Any dent visible to the eye in the rim flange area should be straightened with a hammer, and any hammer dents should be smoothed out with a file.

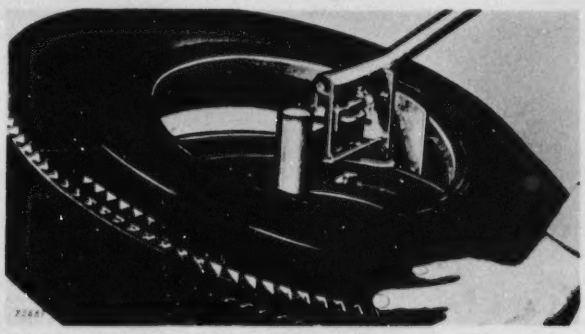


3. Inspect for porous butt-weld. Grooves or high spots (in bead area only) must be filed flat and smooth or tire assembly may lose air.

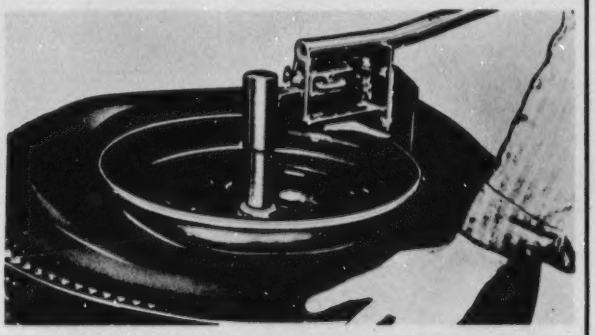
I — MOUNTING SMALL TIRES FOR IMPLEMENTS AND TRUCKS

In every case, be sure to follow the proper procedure for preparation of the tubeless rim before mounting the tire (Fig. 43). Use a thin vegetable oil soap solution or approved rubber lubricant for lubricating beads and rims. Any metal tools contacting the tire must be clean and smooth to prevent bead damage (tubeless tires). First, in tubeless tires, install the valve in the rim. Be sure that both inside and outside of rim area around valve hole are clean and free of any burrs. Use steel wool or file. When installing rubber snap-in valve, lubricate valve before installing. Use valve inserting tool to be sure valve base is firmly seated against inside of rim surface. Be careful to avoid damage to threads or other parts of valve.

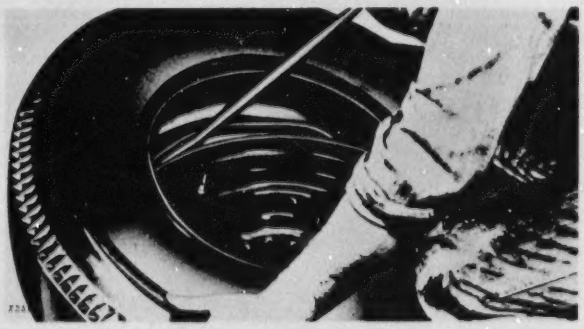
With a Tire Mounting Machine



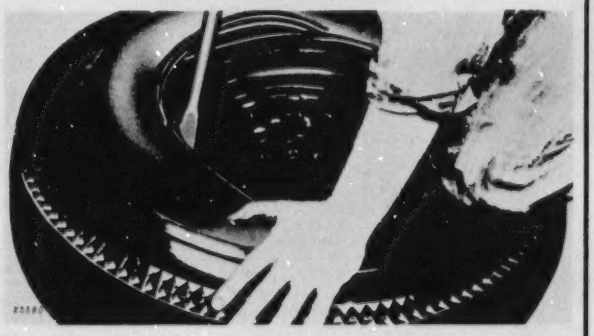
After preparing tire and rim and installing valve, lubricate base of tire beads and the rim. Mount the first bead as shown above. If tire contains a tube, install the tube, making sure the valve is properly located in the valve hole. Inflate the tube just enough to almost round it out. Apply the portion of the bead nearest the valve last to eliminate any possibility of the bead catching on the valve base. Line up balance mark (if any) on the tire sidewall with the valve in the wheel.



Without a Mounting Machine



Lubricate tire beads and rim. Mount first bead by taking small "bites" around the rim with smooth, clean tire irons. Be careful not to damage beads. If tire has a tube, mount as instructed above. Mount second bead in same manner as first.



Apply portion of bead nearest valve last. Line up balance mark (if any) on the tire sidewall with valve in wheel. Do not use a hammer.

Fig. 44 — Mounting Small Tires For Implements And Trucks

MOUNTING INNER TUBES ON TUBE-TYPE TIRES AND INFLATING

1. While mounting (see Fig. 44), insert tube in tire and inflate until nearly rounded out.

2. Using a brush or cloth swab, apply a solution of neutral vegetable oil soap in the areas shown in black (A, Fig. 45), including the flap. Do not allow the soap solution to run down into the tire.

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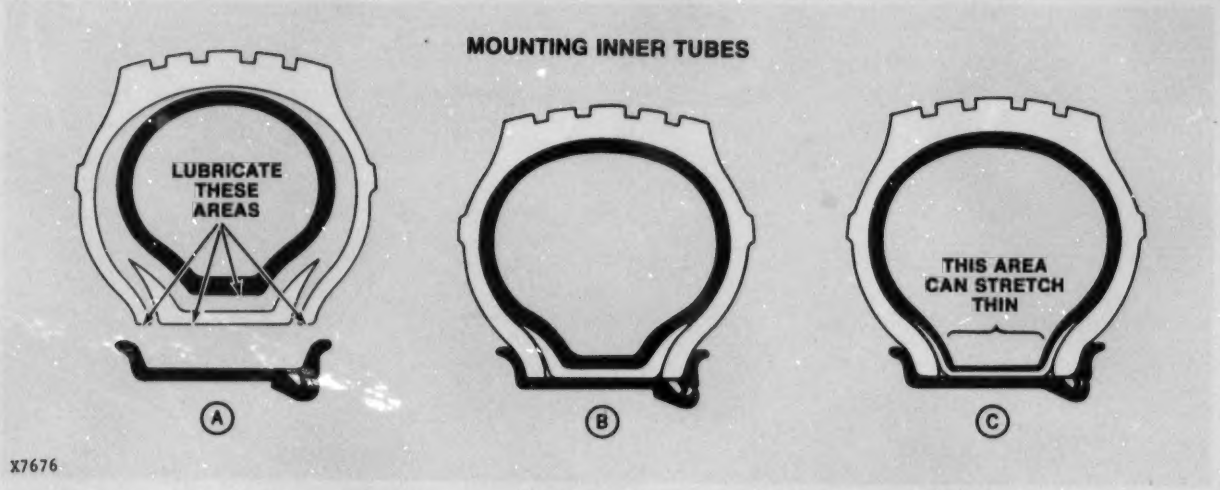


Fig. 45 — Mounting Inner Tubes On Small Tube-Type Tires

3. Mount tire on rim, center the valve, and pull it through hole in rim and hold firmly against the rim. Hold in this position while inflating until beads are properly seated **(do not exceed maximum recommended pressure — 35 psi).**

4. Completely *deflate* by removing valve core or using deflating tool. *This is extremely important to prevent tube buckling.*

5. Reinflate to recommended pressure.

IMPORTANT: Unless the tube and flap are lubricated, they will be stretched thin in the tire head and rim areas (C), causing premature failure.

INFLATING TUBELESS TIRES AFTER MOUNTING

After the tire is mounted on the rim, start inflating it in the usual manner (Fig. 46).

CAUTION: DO NOT STAND OVER THE TIRE WHILE INFLATING IT.

If the beads do not contact both rim seats enough to retain air, spread the beads by constricting the tread centerline of the tire. This is easily done using a mounting band (bead expander) as shown in Fig. 46.

Inflate tire just enough to move beads out to contact bead seats on rim. Then, for safety, remove the bead expander. Increase air pressure as needed — **not over 35 psi** — to fully seat tire beads on rim.*

If beads will still not seat, deflate tire and lubricate it again. Then center tire on rim and reinflate it.

Check for leakage, then adjust air pressure to recommendation.

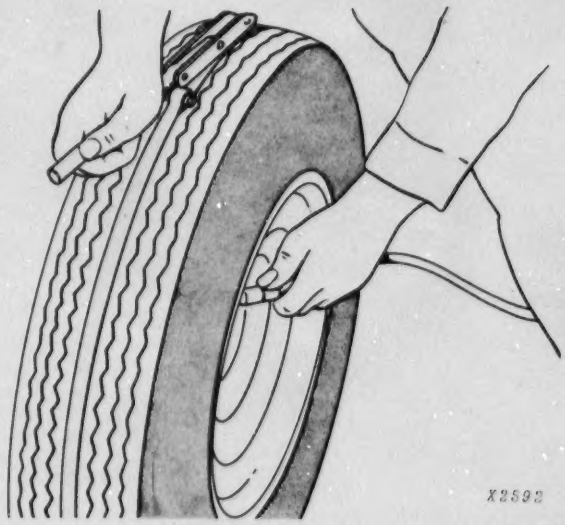


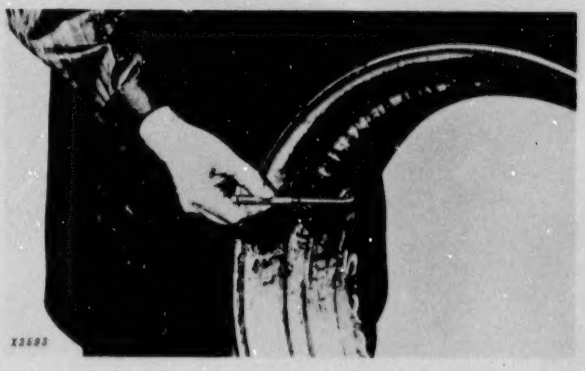
Fig. 46 — Using Tire Bead Expander While Inflating Tubeless Tire — DO NOT STAND OVER TIRE

On safety or hump-type rims, make sure the tire beads have snapped over hump or rim and are fully seated.

***CAUTION: Failure to follow proper procedures when mounting a tire on a wheel or rim can produce an explosion which may result in serious injury or death. Do not attempt to mount a tire unless you have the proper equipment and expertise to perform the job.**

When seating tire beads on rims or wheels, never exceed maximum inflation pressures specified by tire manufacturers for mounting tires. Inflation beyond this maximum pressure may break the bead, or even the rim, with dangerous explosive force.

II — DEMOUNTING LARGE TIRES FOR IMPLEMENTS AND TRUCKS



1. Remove valve cord to completely deflate tire.

2. With tire lying flat on floor (wide side of rim up), loosen upper bead from rim seat by walking around on tire with heels at points close to rim. Use tire iron, exercising caution to prevent damaging the tire or rim. Then turn assembly over so wide side of rim is down. Make sure top bead is loose, then lubricate it and bead area of rim thoroughly. With stops toward rim, insert spoon ends of both tools about 10″ apart. While standing on tire to hold bead in gutter, pull one tool toward center of rim.

3. Hold tool in position with one foot and pull second tool toward center of rim. Progressively work bead off rim, taking additional bites if necessary.

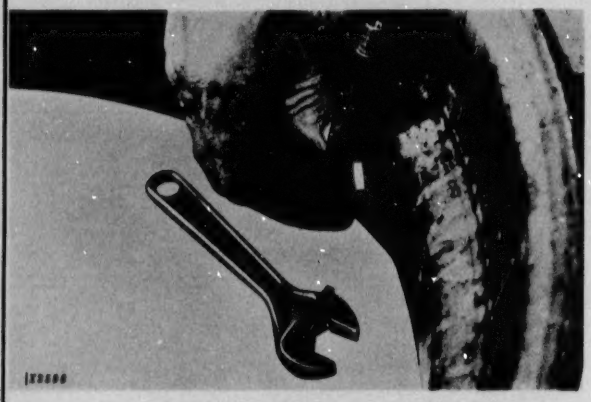
4. Stand assembly in vertical position. Lubricate second bead and rims. At top of assembly insert straight end of tool between bead and back flange of rim at about a 45° angle, far enough to get the stop on the tool resting on the rim flange.

5. Turn tool so that it is perpendicular to rim. Pry second bead off.

Fig. 47 — Demounting Large Tires For Implements And Trucks

II — MOUNTING LARGE TIRES FOR IMPLEMENTS AND TRUCKS

Follow the steps outlined in Fig. 43 to prepare the rim for mounting. Be sure rim is clean and use an approved thin vegetable oil soap solution or rubber lubricant for lubricating beads and rim.



1. Place valve stem with rubber washer through valve hole from rim well side. Screw on valve nut from opposite side making sure the rubber bushing and metal collar on nut are centered and fit snugly in valve hole. Finish tightening with wrench.

2. Place rim on floor with wide side down and lubricate first bead of tire and upper bead seat of rim.

3. Push first bead over flange and into rim well. Using straight end of tool (with stop resting on rim flange) take small bites to work remaining section of first bead onto rim.

4. Start second bead over rim flange into well by standing on tire. When necessary, push section of bead into rim well and anchor with locking pliers by pinching pliers onto rim flange (snub side toward tire). Using spoon end of tire iron with stop toward rim, work progressively around bead using small bites until bead slips over flange onto rim base. If necessary, insert second tire iron and lubricate last 8 inches of bead before completing mounting.

Fig. 48 — Mounting Large Tires For Implements And Trucks

II — CHANGING LARGE TIRES FOR IMPLEMENTS AND TRUCKS

DEMOUNTING TIRES (Fig. 47)

Demounting large tubeless truck or implement tires is similar to what we described for smaller tires. Follow the steps outlined in Fig. 47 on the preceding page.

MOUNTING TIRES (Fig. 48)

Follow the steps outlined in Fig. 43 to prepare the rim for mounting. Then refer to Fig. 48 above for steps in mounting tires.

With disk wheels, the mounting procedure is the same. In certain larger disk wheels, the dish is so deep that it is difficult to insert the tire tool in the normal way. With the first bead in place, clamp on the locking pliers in the usual manner. Then, to get around the deep dish of the wheel, insert the spoon end of the tool at an *angle* between the dish and the flange. Swing the tool toward the center of the dish and work the bead over the flange as usual.

If the tire uses a tube and flap, after the first bead has been placed on the rim, install the tube and flap into the tire. Inflate the tube just enough to round it out and, with the valve stem in the valve hole in the rim, install the valve stem retaining nut and draw it up snug. Install second bead onto rim as instructed in Step 4 (Fig. 48).

NOTE: Most larger tubeless tires cannot be mounted on conventional rim.

INFLATING TUBELESS TIRES AFTER MOUNTING

Check valve to be sure retaining nut at the base is tight. Also check valve core to make sure it is seated tight in the valve. Stand tire in vertical position and inflate to recommended pressure. DO NOT STAND OVER TIRE WHILE INFLATING.

INFLATING TUBE-TYPE TIRES AFTER MOUNTING

Inflate tire until beads are properly seated — but do not exceed tire manufacturer's recommended pressure. Then completely *deflate* by removing valve core or using a deflating tool. Reinflate to recommended pressure. When the tube and flap are not properly lubricated and mounted, they will be stretched thin in the tire and bead area (C, Fig. 45). This will cause premature failure.

III — CHANGING AGRICULTURAL TRACTION TIRES

Mounting and demounting procedures for traction-type tires are shown in Figs. 49, 50, 51, and 52 on the following four pages. Changing tires both on the machine and off the machine is described.

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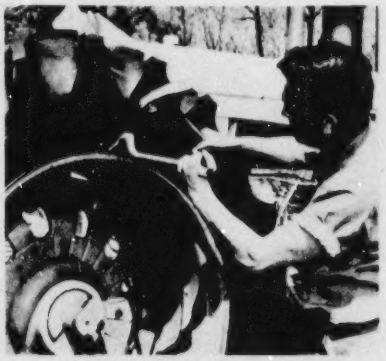
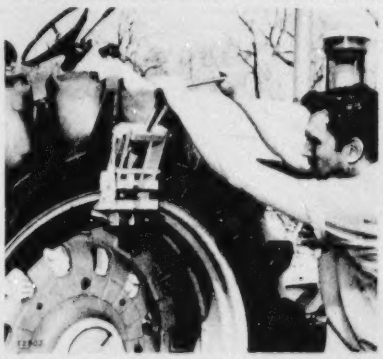
III — DEMOUNTING AGRICULTURAL TRACTION TIRES (ON MACHINE)



1 With vehicle jacked up on the side which is to have the tire removed, and after fluid has been removed, remove rim nut and core housing to completely deflate. Push valve through valve hole.

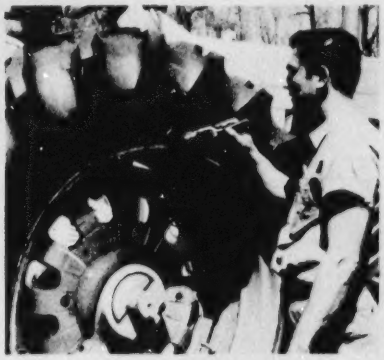
Using a "bead breaking" tool and a heavy hammer, drive the tool between the tire bead and the rim flange, being careful not to damage bead area. Beads should be unseated on both sides of rim.



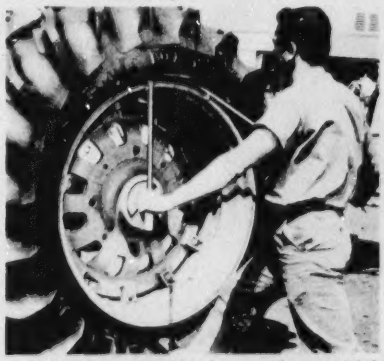
2 As an alternative to the procedure above, a bead unseating tool and instructions are available from Iowa Mold Tooling Company.

Storage Recommendations

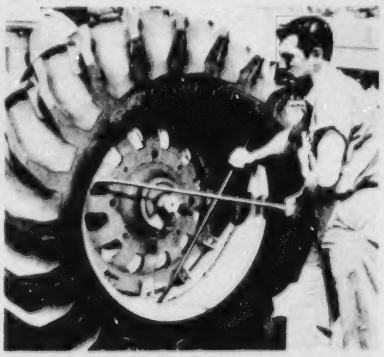
For longest life, tires should be stored unmounted in a cool, dark location—on tread or stacked evenly on the side, but without other material or equipment on top. Implements should not be stored with weight on the tires.



3 Thoroughly lubricate rim flange, tire bead and base of tube with a thin solution of vegetable oil soap in water or equivalent rubber lubricant recommended for this requirement. (Never use petroleum-base solution or silicones.)

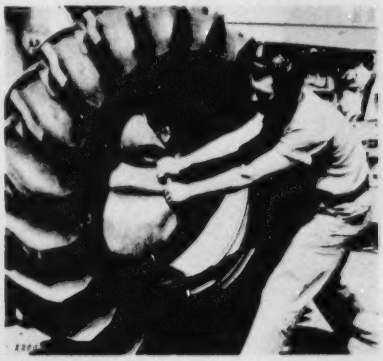


4 Lock wheels by putting vehicle into gear with valve at top. Force outside bead at bottom into rim well. Insert long tire irons under bead at the top and pry bead over rim flange. Take short bites to avoid extremely hard prying and possible damage to tire bead.

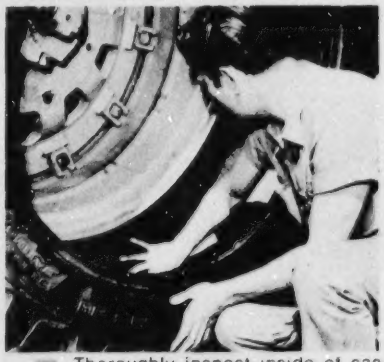


5 After first section of bead is over rim flange, use one iron to hold that section over flange and use other tire iron to pry next section over flange. Do not attempt to pry too large a section over the rim flange at one time.

Safety Precaution — *Never release grip on either iron as they may tend to spring back.*



6 Pull tube out of casing. When only tube requires repair or replacement, this can be done without removing tire completely from rim.



7 Thoroughly inspect inside of casing for foreign material or damage and remove moisture from inside of tire.

8 To remove tire completely from wheel, insert tire irons under the inside bead at side of tire. Pry rest of inside bead over rim flange. When starting this operation, be sure that the bead area on opposite side of tire is down in rim well.

Fig. 49 — Demounting Tractor Tires (On Machine)

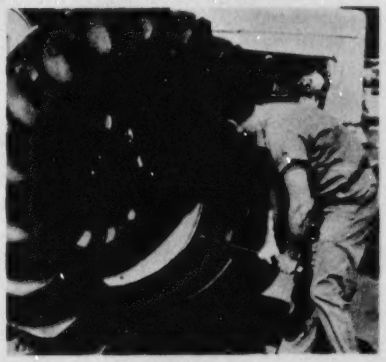
III — MOUNTING AGRICULTURAL TRACTION TIRES (ON MACHINE)

Before mounting a tire on a used rim, be sure the flange area and partciularly the bead seat area is clean and smooth. Remove any buildup of rust, corrosion or old rubber with chisel or wire brush. Bent, cracked or otherwise damaged rims should be repaired or replaced.

Thoroughly inspect inside of casing for foreign material or damage.

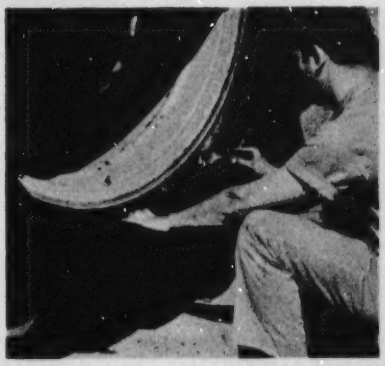
Lubricate both beads with a thin solution of vegetable oil soap in water or equivalent rubber lubricant recommended for this requirement. (Never use petroleum base solutions or silicones.)

Note: Some steps of the following procedure may require two men on larger size tires.

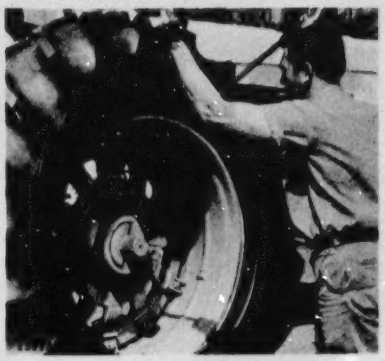


1 To put tire on wheel, place inner tire bead over flange at top. Be sure bead is not on bead seat but is guided into well as tire irons are used to work down either side, forcing rest of inner bead over flange. With first bead on rim, pull tire toward outside of rim as far as possible to make room for tube. Be sure inside of tire is completely dry.

2 Before inserting tube in tire, be sure that valve hole is at bottom of wheel. Align stem with valve hole and place tube in tire starting at the bottom. Place valve in valve hole and screw rim nut on stem to hold it in place. Be sure that tube is well inside rim before proceeding to next step.



3 Tube should be partially inflated and base area that contacts rim should be lubricated to prevent localized stretching.



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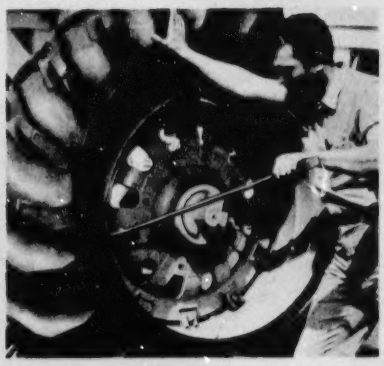
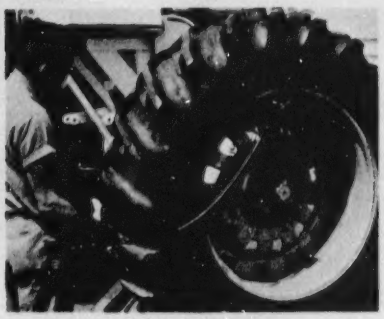


5 After getting first section of outer bead into rim well, place one hand against that section to hold it, and then pry remainder of bead over flange with tire iron in other hand. Do not attempt to pry large sections of bead over flange at one time.

6 Safety Precaution: *Centering the tire is extremely important to prevent broken beads. Remote control inflation equipment should be used. Never stand in front of assembly.*

With valve stem at bottom, lower the jack until tire is centered on rim. Inflate sufficiently to seat beads on rim at bottom.



7 Raise tractor; rotate tire to have valve at top. Inflate to **35 psi** to fully seat beads.

Then remove valve core housing and completely deflate. Reinsert valve core housing and reinflate tire to recommended pressure. Note: If either bead should fail to seat at **35 psi** inflation, the tube may be pinched between tire bead and rim, or something else is interfering with proper mounting.* ***Do not increase inflation pressure over 35 pounds to seat beads,*** but remove valve core housing and completely deflate tube. Unseat both beads from the rim; relubricate both tire beads and rim bead seat areas; reinstall valve core housing, and reinflate tube to **35 psi.** Repeat process until both beads are properly seated.

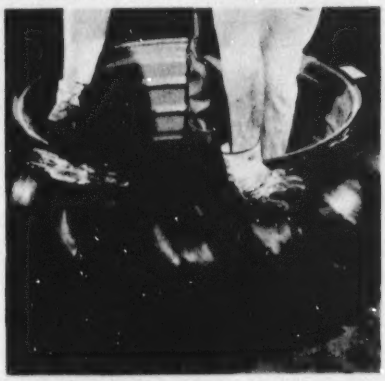
Reduce to operating pressure before putting tire in service.

CAUTION: Failure to follow proper procedures when mounting a tire on a wheel or rim can produce an explosion which may result in serious injury or death. Do not attempt to mount a tire unless you have the proper equipment and expertise to perform the job. When seating tire beads on rims or wheels, never exceed maximum inflation pressures specified by tire manufacturers for mounting tires. Inflation beyond this maximum pressure may break the bead, or even the rim, with dangerous explosive force.

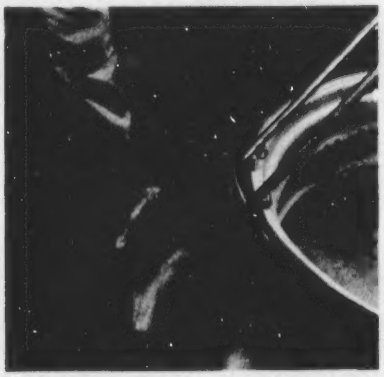
Fig. 50 — Mounting Tractor Tires (On Machine)

III — DEMOUNTING AGRICULTURAL TRACTION TIRES (OFF MACHINE)

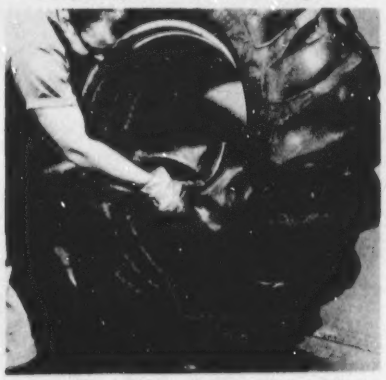
1 To dismount tire, completely deflate tube by removing core housing and remove rim nut. Using a "bead-breaking" tool and a heavy hammer, drive the tool between tire bead and rim flange, being careful not to damage bead area. After bead has been released completely around tire, turn tire and rim over and repeat above procedure with the second bead.



2 Thoroughly lubricate rim flange, tire bead and base of tube with a thin solution of vegetable oil soap in water or equivalent rubber lubricant recommended for this requirement. (Never use petroleum-base solution or silicones.)



3 With part of top bead forced into rim well, pry opposite side of bead over rim flange using two long tire irons. Continue until top bead is completely over the rim flange.



4 With weight of tire braced against a solid support, pull tube out of tire casing. When only tube requires repair or replacement, thoroughly inspect inside of tire casing for foreign material or damage and make sure inside of casing is dry before reinserting tube.

5 To completely remove tire from rim, with weight of assembly supported, be sure one side of bottom bead is in rim well and insert tire irons under opposite side of bead. With smaller size tires work bottom bead over rim flange by taking small bites with two tire irons.

6 Stand large section heavy tires on tread. With weight of assembly supported, and one man holding rim, the second man can work second bead over rim flange until rim drops out.

Storage Recommendations

For longest life, tires should be stored unmounted in a cool, dark location—on tread or stacked evenly on the side, but without other material or equipment on top. Implements should not be stored with weight on the tires.

Fig. 51.— Demounting Tractor Tires (Off Machine)

III — MOUNTING AGRICULTURAL TRACTION TIRES (OFF MACHINE)

1 Before mounting a new tire on a used rim be sure the flange area and particularly the bead seat area is clean and smooth. Remove any buildup of rust corrosion, or old rubber with chisel or wire brush. Bent, cracked or otherwise damaged rims should be repaired or replaced. Rim should be laid on the floor with the valve hole on the top side. In the case of a deep well rim, the deep well must always be on top.

Inflate tube until it is rounded out and insert it in the tire with the valve on the top side before starting to mount tire on rim. Lubricate bottom tire bead and top rim flange with a thin solution of vegetable oil soap in water or equivalent rubber lubricant recommended for this requirement (never use petroleum-base solutions or silicones).

Push bottom bead over rim flange as far as possible. With the tire cocked on rim, screw rim nut finger-tight on valve stem to hold it in place.

2 Using long tire irons, work first tire bead completely over rim flange.

3 Starting opposite the valve, use tire irons to lift top bead over the rim flange and down into rim well. Care must be used to avoid pinching tube with tire irons. When bead is well statred, lubricate remaining unmounted portion of tire bead and rim flange.

4 Tire bead must be forced into rim well when working tire bead over rim flange (lifting opposite side of bead may be required to do this). For small tire, stand on half of tire which is in rim well and work equally around both sides to spoon tire bead over rim flange until final section drops over at the tube valve. Do not attempt to pry large sections of bead over flange at one time.

***CAUTION: Failure to follow proper procedures when mounting a tire on a wheel or rim can produce an explosion which may result in serious injury or death. Do not attempt to mount a tire unless you have the proper equipment and expertise to perform the job. When seating tire beads on rims or wheels, never exceed maximum inflation pressures specified by tire manufacturers for mounting tires. Inflation beyond this maximum pressure may break the bead, or even the rim, with dangerous explosive force.**

5 With large section tires a second man may be required to hold tire bead in rim well — either with tire iron or by standing on the tire sidewall.

6 Safety Precaution: *Centering the tire is extremely important to prevent broken beads. Remote control inflation equipment should be used. Never stand over the assembly when inflating.*

Center the tire on the rim and inflate to **35 psi.** Then remove valve core housing and completely deflate. Re-insert valve core housing and reinflate tire to recommended pressure. Note: If either bead should fail to seat at **35 psi,** the tube may be pinched between tire bead and rim, or something else is interfering with proper mounting.* ***Do not increase inflation pressure to seat beads,*** but remove valve core housing and completely deflate tube. Break both beads loose from the rim; relubricate both tire beads and rim bead seat areas; reinstall valve core housing, and reinflate tube to **35 psi.** Repeat until both beads are properly seated.

Reduce to operating pressure before putting tire in service.

Fig. 52 — Mounting Tractor Tires (Off Machine)

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IV — CHANGING LARGE TIRES FOR OFF-THE-ROAD, INDUSTRIAL EQUIPMENT

Mounting and demounting large off-the-road tires is a difficult job. Often, service must be performed in rough terrain far from a tire service center and proper equipment may be lacking.

This section gives procedures for changing the large tires — both under ideal and difficult conditions.

EQUIPMENT AND TOOLS

Tire changing steps will vary with different operators, but these tools are vital for changing large off-the-road tires:

- **Heavy Equipment Jack.**
- **Tire Tools and Irons.**
- **Wheel Blocks.**
- **Air Compressor.**

DEMOUNTING TUBE-TYPE TIRES FOR OFF-THE-ROAD, INDUSTRIAL EQUIPMENT (Fig. 53)

IMPORTANT: For safety suggestions when mounting and demounting tires, please refer to page 44.

1. Securely block all wheels other than the one which is being changed. Jack up enough for the tire to clear the ground. For safety, block up under the axle to prevent falling if the jack should slip.

2. Remove the valve core and exhaust ALL air pressure before starting to demount the tire. On duals, let the air out of both tires. Always install the valve cap to protect the soft metal threads during tire removal.

3. Place the flat hooked end of the special tool into one of the breaking slots between the seat band and the rim flange (A, Fig. 53). With a length of pipe slipped over the straight end of the tool for leverage, twist the tool in a circular direction as shown in (B). Now have a second operator insert another tool between the bead seat and the side flange and, with the same twisting action, hold the amount of space gained with the first tool. Move the first tool forward around the rim, twist and follow up with the second tool (C, Fig. 53). Continue in this way around the bead seat band until the outer bead is loose.

4. Start the bead seat band in away from the lock ring by placing the tool in the gutter section between the ends of the lock ring and prying radially with the tool (D, Fig. 53). Using two tools as in step 3, work completely around the tire.

5. Pry out lock ring by starting at prying notch (E) and working around the tire using two irons to pry and hold as shown in (F).

6. After lock ring has been removed, pry the bead seat band out over the gutter section as shown in (G). Remove bead seat band, together with the side flange, from the rim base.

7. Similar prying notches are provided on the **inside** of the tapered bead rims, and the inside bead may be broken loose from the rim base in the same manner as the other bead.
Another method is to place a small jack between some part of the vehicle and the tire. By extending the jack, pressure is exerted to force the tire bead off the rim taper. Work progressively around the tire to loosen the bead at all points.

8. Before working the tire off the rim, make certain the valve will clear the gutter section.

9. To work the tire off the rim, first force the tire outward as far as possible at the bottom, then lower the jack enough that the weight of the tire is resting on the ground. This will provide clearance at the top to permit you to force the tire out at the top by pushing or prying. Hold the upper part of the tire as far out as possible, and raise the jack so weight of tire is resting on top of rim and clearance is gained at the bottom. By alternating at top and bottom in this way, the tire can be "walked" off the rim without having to work against the weight of the tire binding on the rim. A hoist or crane aids in this operation.

10. Completely remove the tire from the wheel and leave the tire in vertical position, leaning against the vehicle or some other solid object.

11. Remove flap from the tire, using a tool with a rounded end to pry out and away from the beads (H, Fig. 53). On some types of tires, you may have to use a tire spreader or a small auto jack to spread the beads and assist in removing the flap.

12. Remove the tube in the same manner, being careful not to pull on the valve stem or to enlarge any injuries.

IV — DEMOUNTING TUBE-TYPE TIRES FOR OFF-THE-ROAD, INDUSTRIAL EQUIPMENT

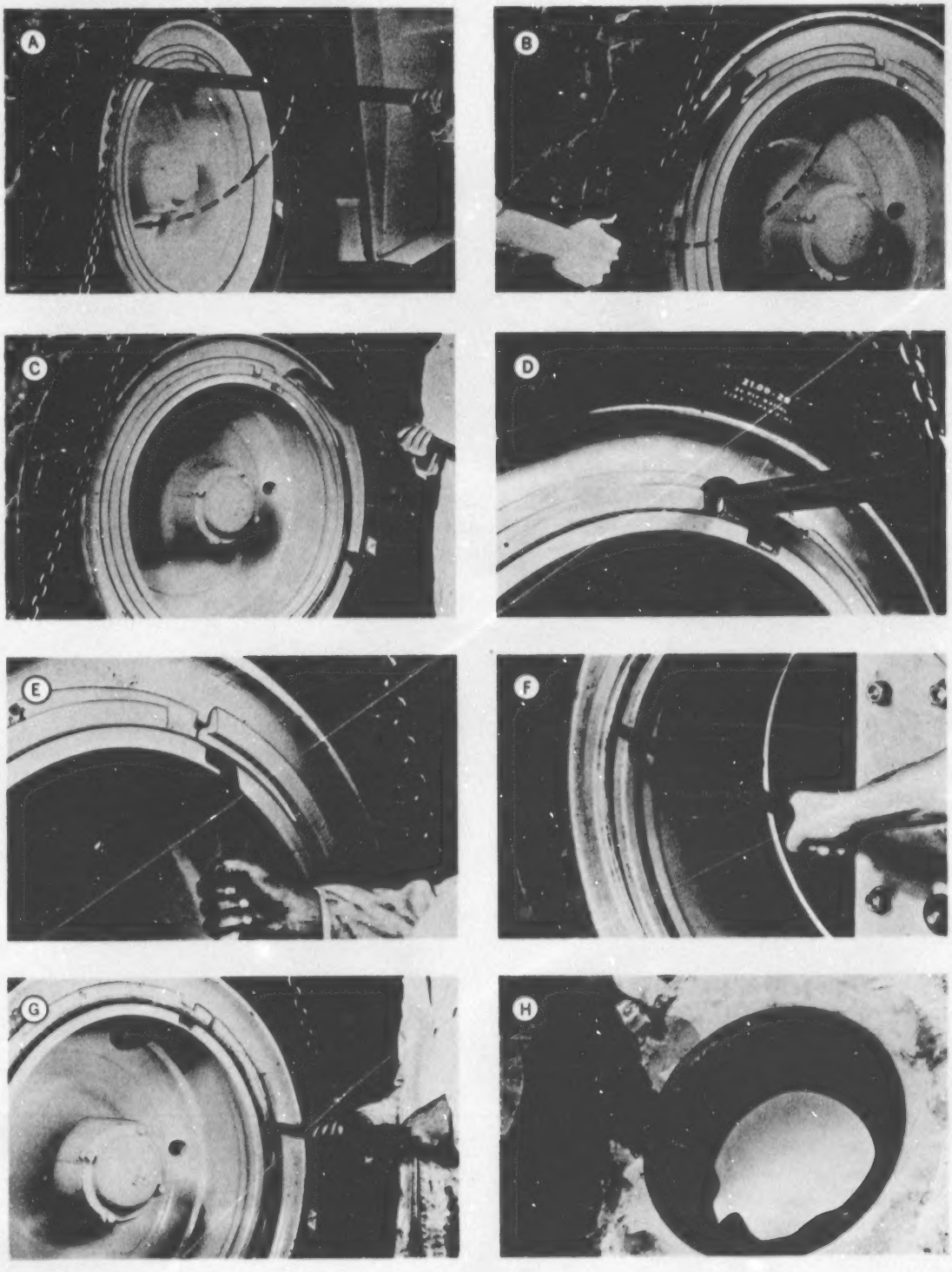

Fig. 53 — Demounting Tube-Type Tires For Off-The-Road, Industrial Equipment

MOUNTING TUBE-TYPE TIRES FOR OFF-THE-ROAD, INDUSTRIAL EQUIPMENT (Fig. 54)

Before remounting tire on the wheel, clean rust from rim base and bead seats by wire brushing or sand blasting. Check all rim parts for cracks. Replace unsafe parts with new ones of the same make. Paint these surfaces, preferably with one coat of zinc chromate, red lead, or a good grade of aluminum paint. Allow paint to dry thoroughly.

1. Before installing the tube in the tire, inspect the casing carefully — inside and out — for breaks, bruises, nails, etc. Clean out all dirt and foreign matter from inside the casing (A, Fig. 54).

2. Install tube in casing, starting at the bottom and working around the tire (B). Adding air as the tube is worked in will help to hold it in place and eliminate the possibility of wrinkles.

3. Insert flap in casing, making sure it is properly centered and free from wrinkles. Rotate the tire as the flap is worked in (C) so the portion being inserted is at the bottom of the tire.
In some cases, it may be necessary to spread the beads, using spreader or car jack. Lubricate beads with approved rubber lubricant.

4. Install rear flange on rim base and align driving lug with slot in rim (D).

5. Hoist or roll tire into position, making sure valve stem aligns with the valve slot before sliding tire onto the wheel. If hoist is not used, lower wheel far enough to permit top of tire to be hooked over top of rim, then raise wheel and "walk" tire on in the same manner as described for demounting (page 36).

6. Hook two of the rack tools into the rim gutter approximately 4 inches from either side of the valve slot (E, Fig. 54). Place the bead seat band in the outside flange, aligning the drive lug on the flange with the slot in the bead seat band. Install the bead seat band and side flange in rim base by hooking them over the two side tools and sliding on the rim. Be sure the driving lug on the bead seat band is aligned with the valve slot in the rim base.

7. Engage two of the bar tools in the proper notches of the rack tools and force the bead set band into position by prying. Holding pressure against band with one tool, slide the other rack and tool around the circumference of the rim, stopping approximately every foot to pry the bead seat band in place (F, Fig. 54). Follow up with second rack and tool to hold pressure against band and keep the clearance gained.

8. After going around the rim once in this manner, it should be possible to hook one of the bar tools into the gutter for additional prying (G). Continue to work around the rim, using the two tools without the racks (H), until the bead seat has been forced one to 1⅛ inch inside the gutter edge.

9. Hold the band in this position and drive the tapered end of bar tool, or any tapered wedge, between the bead seat and the rim base, directly under the break in the bead seat band (I).

10. Hook one end of the lock ring into the gutter (J). Pry or snap the lock ring into place using the tapered ends of the two bar tools (K). When lock ring is in place, remove wedging tool from between ends of lock ring.

11. Pry the bead seat band out over the edge of the lock ring, making certain no "binding" occurs when this is done.

CAUTION: NEVER START TO INFLATE A TAPERED BEAD TIRE UNLESS THE BEAD SEAT BAND HAS BEEN PRIED OUT OVER THE LOCK RING AND FOR SAFETY, USE AN INFLATION CAGE.

CAUTION: Failure to follow proper procedures when mounting a tire on a wheel or rim can produce an explosion which may result in serious injury or death. Do not attempt to mount a tire unless you have the proper equipment and expertise to perform the job.
When seating tire beads on rims or wheels, never exceed maximum inflation pressures specified by tire manufacturers for mounting tires. Inflation beyond this maximum pressure may break the bead, or even the rim, with dangerous explosive force.

12. Check to make sure that driving lugs on both flanges are engaged, and inflate to approximately 75 psi to insure proper seating of the beads. Then completely **deflate** to remove buckles and uneven stresses from the tube and flap before inflating to correct operating pressure. This double inflation is necessary to prevent premature tube failures.

CAUTION: Use a clip-on chuck and extension hose long enough to allow you to stand well to one side and NOT in front of the assembly while inflating.

13. Check newly mounted tires to be sure they are at proper inflation pressure before they go into service. Check again after the first two or three trips to eliminate the chance of a leaky valve or a bad tube ruining a good tire through underinflation.

IV — MOUNTING TUBE-TYPE TIRES FOR OFF-THE-ROAD, INDUSTRIAL EQUIPMENT

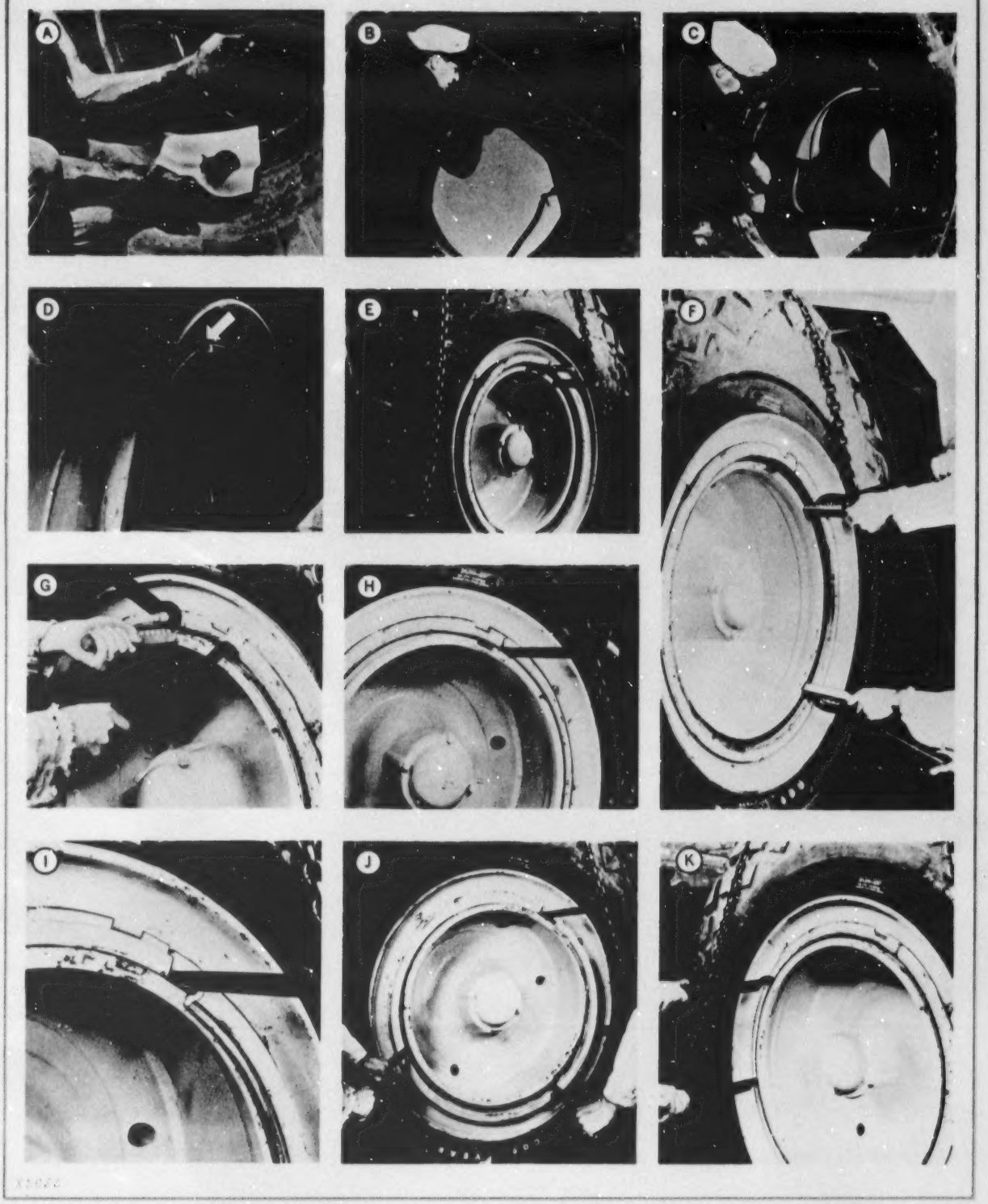

Fig. 54 — Mounting Tube-Type Tires For Off-The-Road, Industrial Equipment

FOS — 55 Litho In U.S.A.

DEMOUNTING TUBELESS TIRES FOR OFF-THE-ROAD, INDUSTRIAL EQUIPMENT (Fig. 57)

A hydraulic tire remover (A, Fig. 57) will normally be needed to demount large tubeless tires from their rims.

1. Prepare the unit by blocking the same way as for tube-type tires (page 36).

2. Before making any attempt at demounting, be sure that the tire and rim assembly have been COMPLETELY DEFLATED. For complete deflation, it is best to remove the valve core.

3. Securely tighten the adjusting screws at the bottom of the tire remover jaws (B, Fig. 57). Set the hand screw against the lock ring and adjust until the jaw assembly is at a right-angle position to the plane of the flange (C).

4. With the spade tip down, and the ram in the retracted position, insert the spade and ram assembly between the open sides of the frame. Place the spade tip between the tire bead and the rim flange. Lift the ram until the trunnion engages the frame shoulder support and move the stop screw into the support ram (D).

5. Apply pressure to the ram and spade with the pump until the spade has moved the tire bead toward the center of the rim assembly far enough to permit the placing of a bead wedge between the bead and the flange on each side of the tool (E). Release the pump pressure. Remove the spade ram assembly from the frame. Loosen the clamping jaw screws and remove the flange.

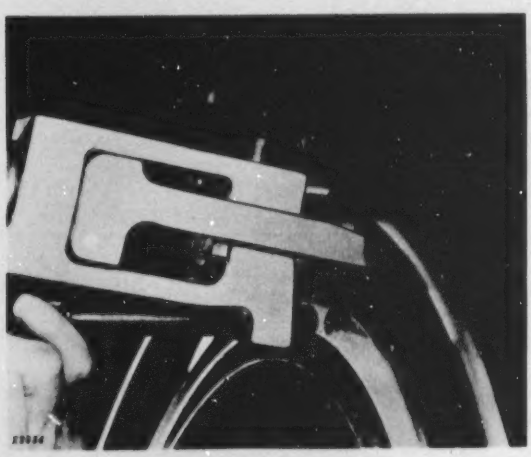

Fig. 55 — Hydraulic Tire Remover Which Breaks Giant Tire Beads On Rusted Rims

6. Move to a spot approximately 60 degrees from the first application (in either direction) and repeat the entire procedure (F). Repeat until the tire is freed from the rim — four or five applications may be required.

7. When using this tool on a rim which has a 2-inch flange, you must insert the spade and ram assembly into the frame assembly and tighten before attaching to the flange. This is necessary because of the small clearance between the flange and the tire.

NOTE: To break giant tire beads on rusted rims, use a hydraulic tire remover tool as shown in Fig. 55. This tool can only be used on tube-type rims which have pry bar slots. For detailed instructions, read the manufacturer's manual. Tools are available through your local rim or tire distributor.

MOUNTING TUBELESS TIRES FOR OFF-THE-ROAD, INDUSTRIAL EQUIPMENT

It is important that all rim parts be examined for damage and corrosion. Rims should be clean, especially the groove in which the O-ring gasket seats. A new O-ring should always be used. Lubricate O-rings with vegetable oil soap or rubber lubricant. Tubeless tire changing tools can be ordered through your source of supply. Tools required are off-the-road tire irons and bead breaking tools.

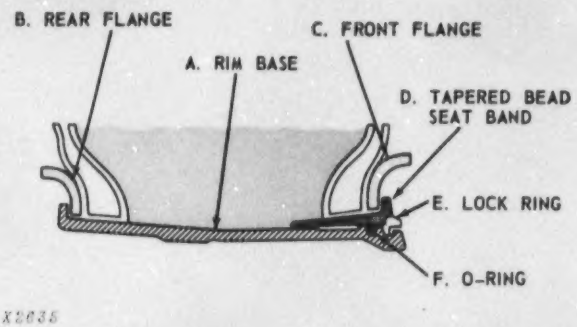

Fig. 56 — Tubeless Tires For Off-The-Road, Industrial Equipment (Mounted On Rim And Inflated)

Fig. 56 illustrates the cross section of a large tubeless tire mounted on a rim and inflated.

Mounting tubeless tires is the same as mounting tube-type tires except for the following:

1. Rims for tubeless tires have similar parts, except a sealing rubber O-ring (F, Fig. 56) which goes between the tapered bead seat band (D) and rim base (A).

2. The rim base (A) does not have a rim slot in it.

(Continued — page 42)

IV — DEMOUNTING TUBELESS TIRES FOR OFF-THE-ROAD, INDUSTRIAL EQUIPMENT

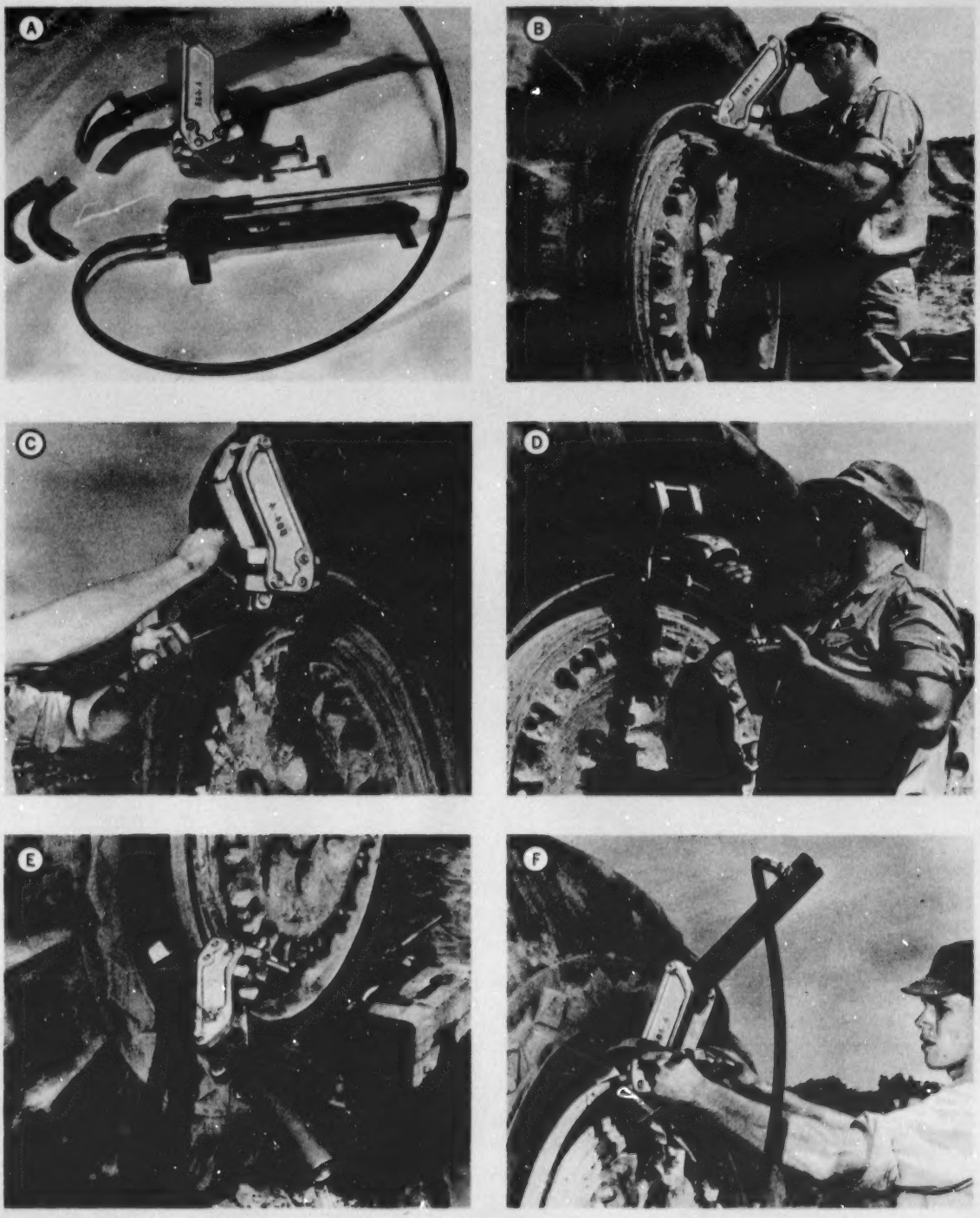

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Fig. 57 — Demounting Tubeless Tires For Off-The-Road, Industrial Equipment

MOUNTING TUBELESS TIRES FOR OFF-THE-ROAD, INDUSTRIAL EQUIPMENT — Continued

3. The tapered bead seat band (D, Fig. 56) is one-piece and is not broken as is the tapered band for conventional rims.

4. Tubeless rims do not have bead breaker pockets.
Before mounting or assembling rim, all parts should be wire brushed thoroughly. This includes the entire rim base, the back flange seat, the O-ring gutter and the lock ring gutter.

Lubricate the O-ring gutter, and the area behind it for approximately 2 inches, with approved rubber lubricant. Make sure the valve stem is properly installed in the rim base.
Tubeless tires can be mounted in two ways:

1. Vertical mounting

2. Horizontal mounting

Vertical Mounting Of Tubeless Tires For Off-The-Road, Industrial Equipment

Fig. 58 — Installing Rear Flange On Rim Base

1. Clean the rear flange and install on rim base. Push flange to the back flange of the rim base. Make sure the drive lug on the flange properly engages the slot in the rim base (Fig. 58).

2. Put the tire on the rim base. Force the tire back as far as possible against the back flange. Be sure to align drive lug with slot in rim base. Place the outside rim flange on the rim base, making sure that the drive lug on the flange is about 5 inches in a clockwise direction (to the right) from the drive lug on the rim base.

Fig. 59 — Installing Bead Seat Band On Rim Base

3. Install the tapered bead seat band over the rim base (Fig. 59), forcing it between the flange and rim base. Be sure to align the drive lug on the flange with the drive lug slot in the tapered bead seat band.

4. Use tire irons to force the outside flange assembly, tapered bead seat band, and the outside tire bead in far enough to clear the ring gutters.

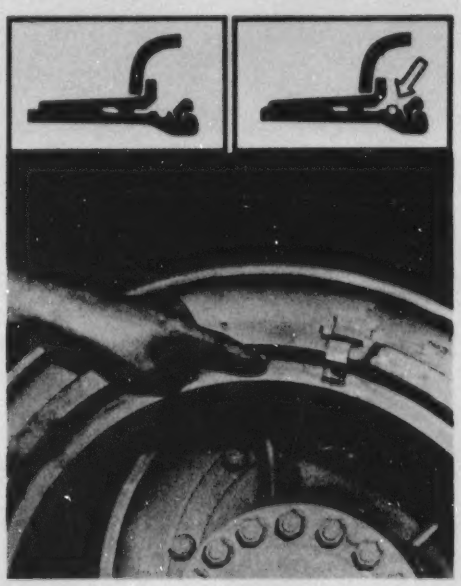

Fig. 60 — Making Sure Drive Lug On Lock Ring Fits In Slot In Rim Base

5. With the tire flange and tapered bead seat band held in the above position, insert the lock ring in the outside gutter. Tap into place with a hammer, making sure the drive lug on the lock ring fits in the slot in the gutter of the rim base (Fig. 60).

6. Be sure all slots and drive lugs are properly aligned. If necessary to move any of the parts, use only a lead or brass hammer.

7. Lubricate O-ring gasket with an approved rubber lubricant. *Always use a new O-ring when mounting a tire. Never re-use old O-ring as it becomes seriously distorted in making a seal. This could prevent a perfect seal if old ring is used.*

8. Place the bottom of the O-ring over the lock ring into the gutter without twisting or rolling. Lubricate the bands, spread ring over the rim base and lock ring, and snap into place at the top (see upper right inset in Fig. 60). *Be careful to place the ring in the gutter without rolling or twisting. Lubricate the O-ring area again by applying rubber lubricant with a brush.*

Fig. 61 — Positioning Bead Seat Band And Outside Flange

9. Pull the tapered bead seat band and outside flange out over the O-ring as tight as possible against the lock ring (Fig. 61). At this point, make sure all rim parts are correctly assembled before inflating the tire.

10. In order to seat the beads, inflate to pressure recommended by tire manufacturer; and then reduce to recommended cold starting pressure. For safety, use an inflation cage. Also, use a clip-on chuck and extension hose long enough to allow you to stand to one side and NOT in front of the assembly while inflating.

CAUTION: Failure to follow proper procedures when mounting a tire on a wheel or rim can produce an explosion which may result in serious injury or death. Do not attempt to mount a tire unless you have the proper equipment and expertise to perform the job.
When seating tire beads on rims or wheels, never exceed maximum inflation pressures specified by tire manufacturers for mounting tires. Inflation beyond this maximum pressure may break the bead, or even the rim, with dangerous explosive force.

11. Check the assembly for air pressure loss. Do not put a tire into service that has a slow leak.

Horizontal Mounting Of Tubeless Tires For Off-The-Road, Industrial Equipment

Horizontal mounting is the same as vertical mounting except for two additional steps:

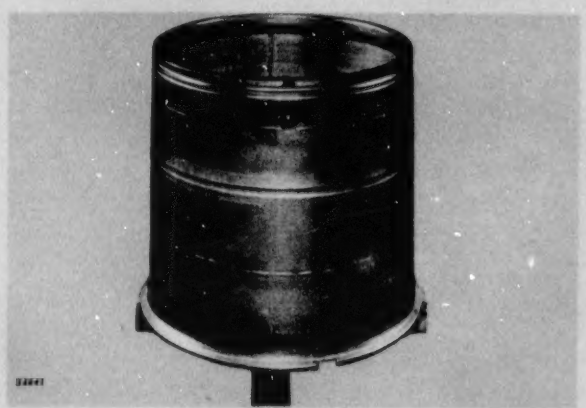

Fig. 62 — Placing Rim Base On Blocks, Gutter Side Up, For Mounting

1. Lay rim base on wood or metal blocks, gutter side up (Fig. 62). The rim should be off the floor enough for the tire to rest on the rim without touching the floor. Blocks should not extend more than ½ inch beyond the rim base to prevent interference with back rim flange.

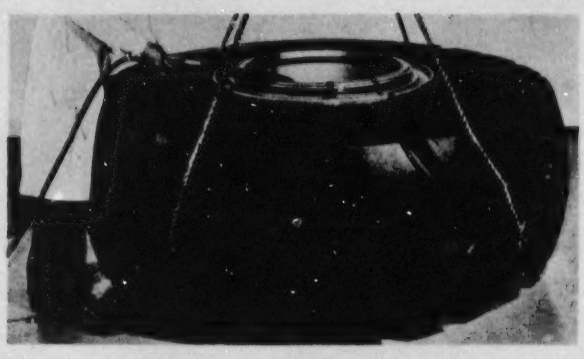

Fig. 63 — Lifting Tire To Contact Bead Seat Band For Mounting

2. Some tires may require slight lifting to contact the bead seat band as shown in Fig. 63.

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SAFETY TIPS FOR LARGE TIRES FOR OFF-THE-ROAD, INDUSTRIAL EQUIPMENT

1. FOR YOUR SAFETY — Remember, an inflated tire and rim can be very dangerous; under pressure it packs the explosive force of TNT. A 10.00 - 20 12PR truck tire inflated to 75 psi has 46,510 Energy Foot-Pounds when it explodes and could raise a 3000 pound car to 15 feet. An 18-22.5 16PR tire with 75 psi develops 103,789 Energy Foot-Pounds and could hurl an 83-pound object over the Empire State Building. A 24.00 - 49 tire inflated to 75 psi develops 354,260 Energy Foot-Pounds and could lift a 134-pound man one-half mile into the air!

2. Be sure to remove the valve core and exhaust **all** air from the tire. Check the valve stem by running a wire through the stem to be sure it is not plugged. A broken rim part under pressure could blow apart and kill you the moment you remove the lugs on a dual assembly. Remove valve cores from **both** tire assemblies. Exhaust ALL air from both tires before starting to loosen the lug nuts.

3. Regardless of how firm the ground appears, place hardwood blocks under the jack.

4. Use a clip-on chuck and extension hose long enough to allow you to stand to one side and NOT in front of the tire assembly while inflating it.

5. Be very careful to clean all dirt and rust from the lock ring gutter. This is important to allow the lock ring to secure in its proper position. Inspect the rim base and lock ring gutter for cracks. Any cracked, damaged, or sprung rim bases or lock rings should be replaced.

6. Block the tire and wheel on the **other** side of the vehicle before you place the jack in position; ALWAYS crib up with blocks just in case the jack should slip.

7. Remove the bead seat band slowly to prevent it from dropping off and crushing your toes. Support the band on your thigh and roll it slowly to the ground. This will protect your back and toes.

Fig. 64 — Large Off-The-Road Tires Require Extra Safety Precautions

8. Bead breakers and rams apply pressure to bead flanges. **Keep your fingers clear.** Slant bead breaker about 10 degrees to keep it firmly in place. If it slips off, it can be thrown with enough force to kill. **Always** stand to one side when you apply hydraulic pressure.

9. When using a cable or chain sling, stand clear. It might snap and lash out.

10. When lock rings are tapped with a hammer during the first part of inflation, STAND TO ONE SIDE when you swing the hammer. If the lock ring should blow off, it and other parts could fly off with terrific force.

11. Never mix rim parts of different brands. Do not try to use the wrong-size rim flange. Never, never use bent, chipped, or broken rim parts. They are dangerous and can cause injury.

12. Never attempt to rework, weld, heat, or braze wheel parts. Always replace with new parts of the same size, type, and make.

13. Spare tires mounted on demountable rims should only have enough air pressure to keep the rim parts in place. **Never transport a fully inflated tire.** Inflate tires to correct operating pressure **after** the tire and rim assembly have been fastened in place with all lug nuts properly torqued.

SUMMARY: TIRES

We have tried to cover all the common types of tires used on today's farm and industrial machines.

After this review, it should be obvious that, unless you have a very large operation, tire service and repairs are better left to those in the tire business.

Without proper tire equipment, which is expensive, it is usually unsafe and impractical to make satisfactory tire repairs.

Nevertheless, you should know how tires are constructed and rated, how they are inflated and ballasted, how they fail, and how to perform basic tire maintenance. This we have tried to do in this story.

TEST YOURSELF

QUESTIONS

1. Which of the items below is not true of off-the-road tires (when compared to over-the-road tires)?

   a. Operate at lower speed

   b. Generate less heat

   c. Receive less shocks

2. If a tire size is "24.5 - 32", what do the two numbers tell you?

3. Which way should the V-treads face on a farm tractor drive tire when viewed from the front?

   a. Upward (∧)

   b. Downward (V)

4. True or false? "Tires are designed to operate with some sidewall deflection or bulge."

5. Will underinflated tires wear more on the sides or the center of the tread?

6. Match each item below with the correct answer at the right:

a. Too much ballast	1. Tire tread pattern wiped out
b. Too little ballast	2. Tire tread pattern visible but broken or shifted
c. Proper ballast	3. Tire tread pattern a distinct mold of tire

7. What is the proper tire slippage for a farm tractor under load in the field?

   a. No slip

   b. 10-15 percent slip

   c. 20-25 percent slip

8. When filling a tire with liquid ballast, how full should it be?

   a. 75%

   b. 90%

   c. 100%

9. If rubber tires are operated for a long period on hard surfaces, should inflation pressure be at the highest or lowest level recommended?

10. How should minor cuts or snags on the rubber of the tire lugs be treated?

11. True or false? "Hot patches make a better repair for punctured tires than cold patches."

12. How should tires be stacked up for storage?

13. After mounting a tube-type tire, why should it be inflated and then deflated again?

14. True or false? "The safest place to stand while inflating a tire is over it."

(Answers on next page.)

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ANSWERS

1. Item "c" is *not* true.

2. "24.5" tells the width of the tire in inches, while "32" gives the diameter of the rim.

3. b. Downward.

4. True.

5. Sides of the tread will wear more.

6. a-3; b-l; c-2.

7. b. 10-15 percent slip.

8. a. 75%

9. Highest

10. Bevel out the cut or hole with a knife (to prevent more tearing or picking up of stones).

11. True

12. They should **not** be stacked as this will distort them. The best way is to mount them and store in a vertical position.

13. To prevent buckling or pinching of the tube.

14. False! Stand to the side, away from the tire.

TRACKS / PART 2

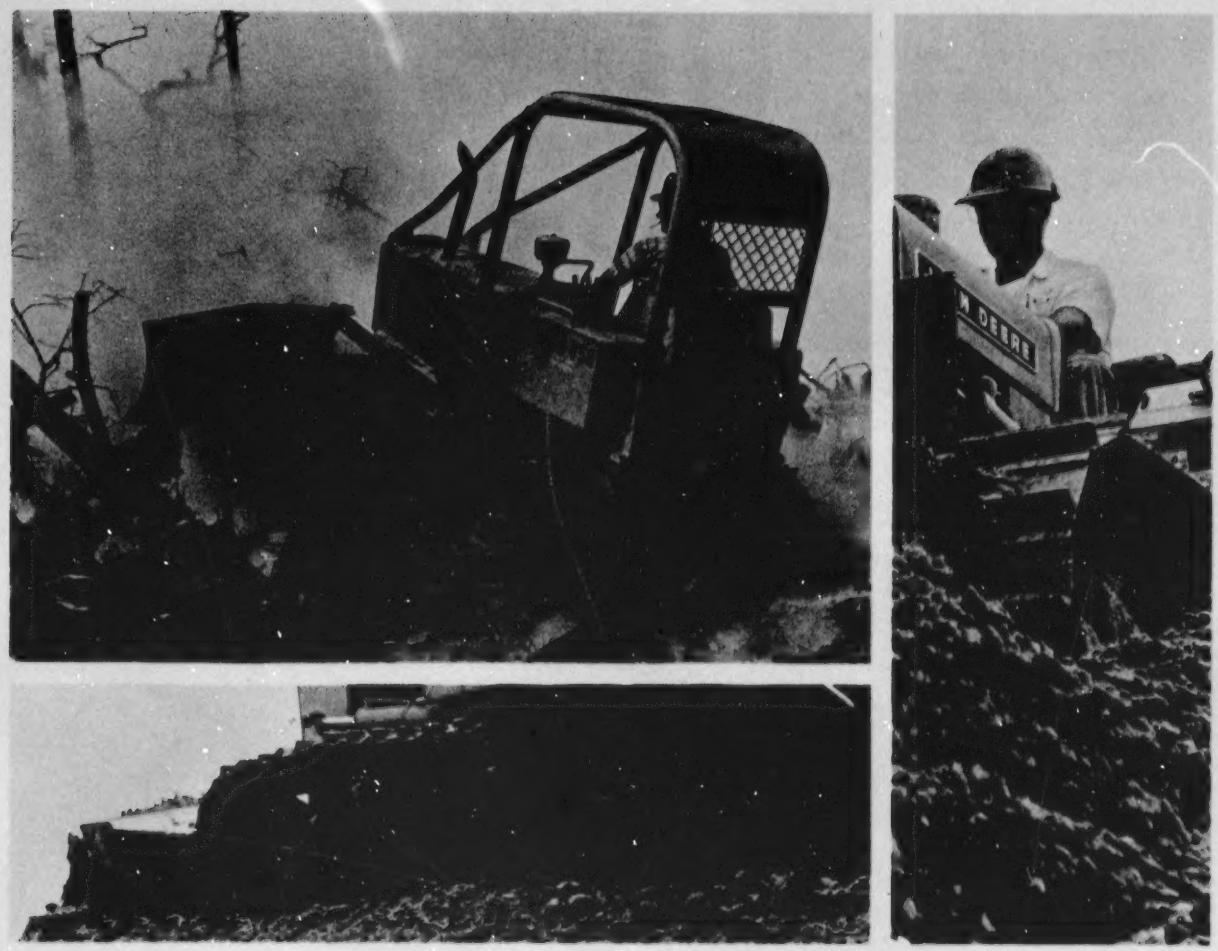

Fig. 1 — Tracks Are A Big Investment

INTRODUCTION

The track and undercarriage may represent 20 percent of the purchase cost and **50** percent of the service cost of a crawler tractor. This makes good operation and maintenance of tracks a major concern of owners and service shops.

Tracks are built rugged for use in muddy, rocky, or loose soil conditions. However, reckless operation can put violent shocks on track parts and fail them early. Not keeping tracks adjusted and in good repair can do equal harm.

Let's look at the track and undercarriage — how it works, how it can fail, and how to adjust and repair it.

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OPERATION

Tracks are like roller chains with shoes (Fig. 2). Each track system has seven basic parts:

- **Track — endless chain**
- **Drive Sprocket — drives the track**
- **Rollers — support and align track**
- **Front Idler — maintains track tension**
- **Tension Mechanism — adjusts track tension**
- **Roller Guards — protect rollers and guide track**
- **Frame — supports all track parts**

All these parts together make up the *undercarriage* of a crawler tractor (Fig. 3). One set on each side of the machine, driven by the tractor's final drives, supports and moves the complete machine.

Let's look at the function of each part.

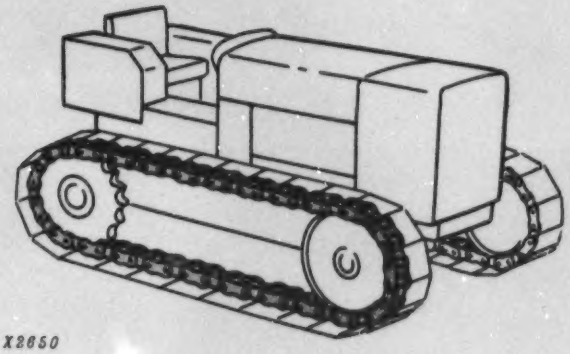

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Fig. 2 — Tracks are Like Roller Chains With Shoes

TRACK

The **track** is an endless chain made up of links, bushings, pins, and shoes as shown in Fig. 4.

Each section of the track is a pair of links fastened together with a bushing at one end and a pin at the other. Both the pin and bushing are "press fit" into the links so the section won't work apart. The pin fits inside a bushing to hold the next pair of links.

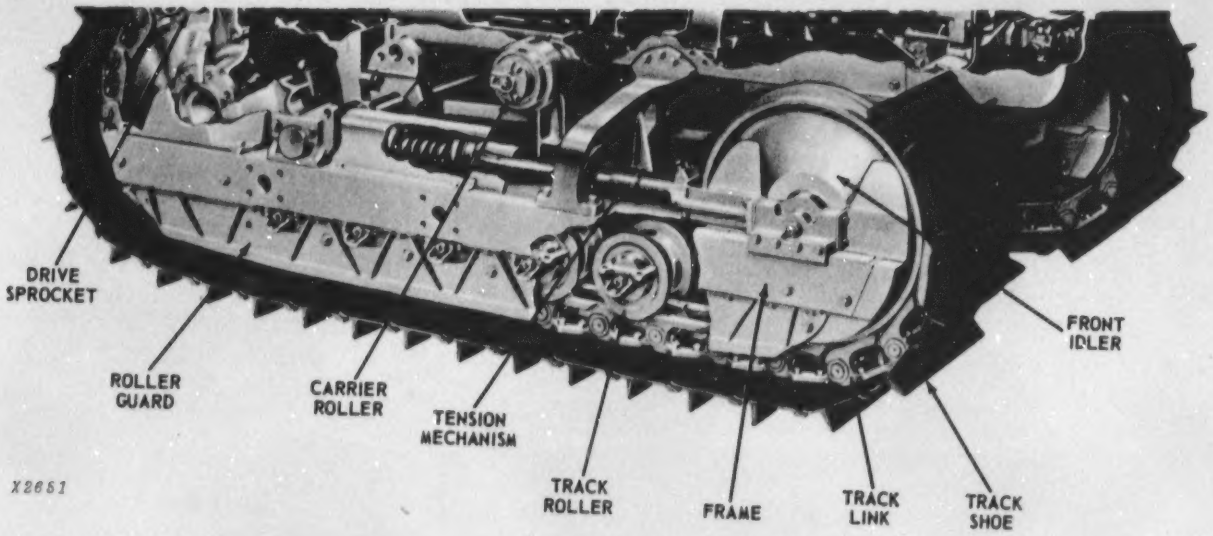

Fig. 3 — Complete Track or Undercarriage of Crawler Tractor

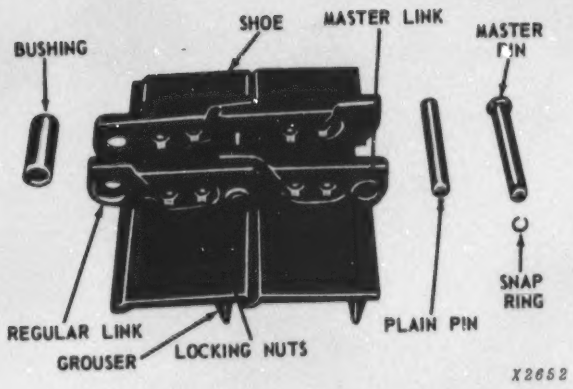

Fig. 4 — Track Links And Shoes

One pin on each track is held in by a snap ring for easy removal when separating the track. This pin is called the master pin (Fig. 4).

A track shoe is bolted to each section to provide traction. The "grip" or grouser on the shoes will vary for use on different terrains (Fig. 5).

Types Of Track Shoes

Standard grouser shoes are widely used on dozer and drawbar machines and provide excellent service for most conditions. They are designed to work in clay, silt, loam, and gravel.

Open-center grousers are a variation which provide openings for mud to squeeze out and prevent build-ups.

Snow shoes have similar slots which prevent snow and ice from packing in the tracks.

All-purpose (multi-grouser) shoes have small, low grousers which make the track more maneuverable. They also have self-cleaning openings. These shoes perform well on hard, smooth surfaces as well as in muddy or soft conditions. They are commonly used on loader units.

Rubber shoes are excellent for use on floors or other smooth surfaces that might be damaged by rough tracks. The wearing life is fairly short compared to steel shoes.

Special track shoes are also available for extreme or unusual conditions. For example, some shoes are extremely hard for use in abrasive conditions. Another shoe for rocky terrain will "work harden" as it is used.

Wider track shoes are sometimes available for special conditions such as loose snow. But remember, for maximum service life, track shoes should never be wider than necessary for the desired flotation.

Types Of Track Chains

Track chains (Fig. 6) are made in two designs:

- **Flush-type**
- **Interlocking-type**

FLUSH-TYPE CHAINS have their bushings flush with the ends of the links.

INTERLOCKING-TYPE CHAINS have their bushings extending into the counterbores of the links as shown. This provides more protection against wear than does the flush-type because less abrasives get into the area between the pin and bushing. They also have more area of contact between pins and bushings, which increases wear life.

Disassembly of each type is different, as we'll see later under "Repairing Tracks."

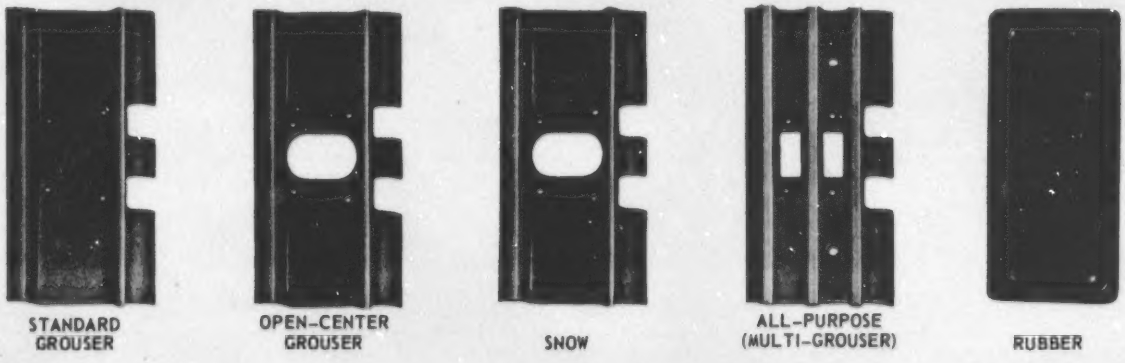

Fig. 5 — Common Track Shoes

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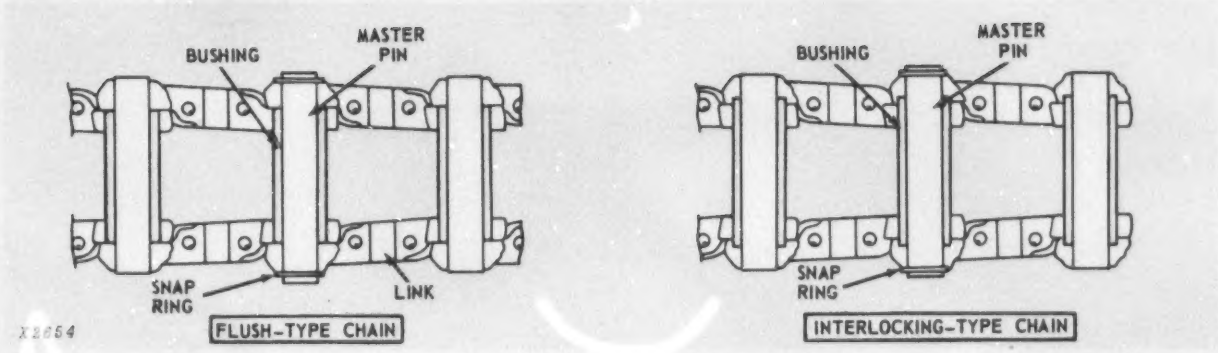


Fig. 6 — Two Types of Track Chains

DRIVE SPROCKET

The **drive sprocket** is driven by the tractor final drive and transmits power to the track (Fig. 8). The "hunting tooth" design of the sprocket produces even wear on the sprocket teeth. Every other tooth engages a track bushing and carries it around the sprocket. Since the sprocket has an odd number of teeth, each tooth contacts a bushing only on *alternate* revolutions.

ROLLERS

In Fig. 8 two types of rollers are shown. The **carrier roller** supports the weight of the upper portion of the track. It prevents the track from sagging, which causes excessive track whipping.

The **track rollers** mounted on the bottom of the frame support much of the machine's weight. They are small and close together to provide even pressure on the track as it revolves and contacts the ground. The weight is then distributed evenly over the entire bottom of the track. This gives the track its great traction and flotation.

FRONT IDLER

The **front idler** supports the track as it revolves (Fig. 8). A tension spring provides constant but flexible tension on the track through the tension mechanism (below).

TENSION MECHANISM

The **tension mechanism** (Fig. 8) is usually a recoil spring and adjustable rod which can be turned manually or actuated hydraulically to tighten or loosen the tracks.

ROLLER GUARDS

The **roller guards** (Fig. 8) protect the rollers from rocks or other obstructions. They also help keep the track free of dirt and debris by preventing it from entering the track chain.

Another vital job of the guards is to *guide* the tracks and prevent twisting and buckling.

FRAME

In Fig. 3 notice that the **frame** supports and holds the track components in place. The front idler slides on the frame, the rollers are mounted on it, and the roller guards are also attached to it. However, the drive sprocket is not supported by the frame. It is supported by its own axle from the final drive and steering clutch housing. On some machines, however, the outer end of the drive sprocket axle is supported by the frame.

Fig. 7 — Avoid Reckless Operation Over Rough Terrain

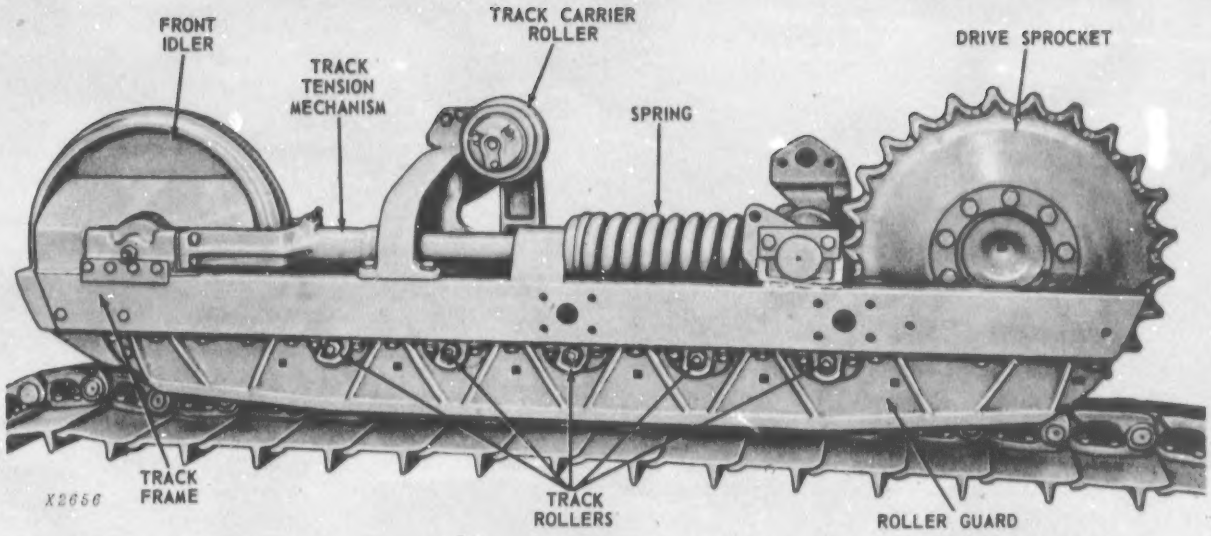


Fig. 8 — Track and Undercarriage of Crawler Tractor

TIPS FOR CRAWLER OPERATORS

These tips for the machine operator can extend track life:

1. *Avoid reckless operation over rough, rocky ground.*
2. *Don't spin the tracks — apply loads gradually.*
3. *Slow down — especially over rough terrain.*
4. *Avoid high-speed operation in reverse.*
5. *Stay off concrete and other hard surfaces when possible.*
6. *Keep roller guards in place — especially when working in rock.*
7. *Clean out packed mud after operating in muddy conditions.*
8. *Check track tension more often when operating in mud, snow, or sand.*
9. *Don't park on side of a hill as this puts a strain on roller seals.*
10. *In freezing weather, park on a hard surface to avoid freezing tracks to ground.*
11. *Check tightness of all track bolts periodically.*
12. *Inspect the track regularly.*

CLEANING, INSPECTING, AND LUBRICATING TRACKS

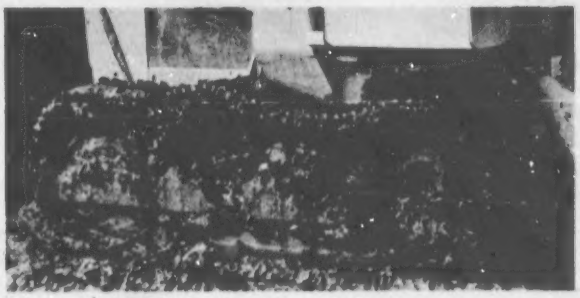


Fig. 9 — Mud Caked on Tracks Means Trouble

Muddy tracks mean trouble if not cleaned before the mud hardens. They cannot operate properly when caked with rock-hard mud (Fig. 9).

Rocks packed into the track can also cause a tight track, resulting in extra wear and stress on the track. The roller guards help keep out rocks, but the tracks should be checked for rocks periodically.

A good **daily inspection** of the track takes only a few minutes but can prevent major problems before they happen.

Inspect the complete track and undercarriage for misaligned, loose, or missing parts. Use a torque wrench to tighten loose bolts, especially on track shoes.

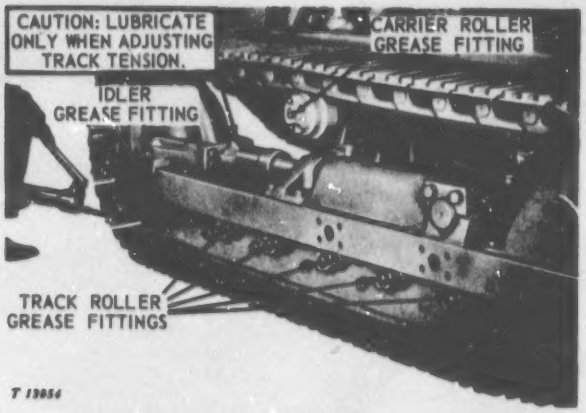

CAUTION: LUBRICATE ONLY WHEN ADJUSTING TRACK TENSION.
CARRIER ROLLER GREASE FITTING
IDLER GREASE FITTING
TRACK ROLLER GREASE FITTINGS
T 13654

Fig. 10 — Lubricate the Track (If Recommended)

The track pins and bushings are hardened and require no lubrication. However, the track rollers, carrier roller, and idler may have grease fittings (Fig. 10). At the correct intervals, clean the fittings and apply the recommended grease. A special low-pressure gun may be supplied with the machine. Normally, grease should be applied only until resistance is felt on the lever of the special grease gun.

IMPORTANT: If track has a hydraulic tension adjuster, never apply grease to this fitting except when adjusting tension. Doing so will overtighten the track.

Some newer tracks have "lifetime" seals which are filled with grease during assembly and need not be lubricated.

ADJUSTING TRACKS

Track performance depends upon two vital adjustments:

- **Track tension**
- **Track alignment**

If the track is too tight, too loose, or misaligned, it will wear rapidly.

TRACK TENSION

For maximum service life of all track components, keep the track properly adjusted. When operating a tractor in snow, mud, clay or some types of sandy loam which tends to pack in the track, check the adjustment often. It may be necessary to loosen the adjustment to keep from operating with overtight tracks.

Be sure to also check the coils of exposed recoil springs. Mud packing in the recoil spring can cause restriction of the idler travel and recoil action. This can result in overstressing the track links, recoil mechanism and final drives.

Track tension is usually correct if the track has about one inch (25 mm) of sag, measured at a point halfway between the carrier roller and front idler (Fig. 11). (See operator's manual for actual recommendations.)

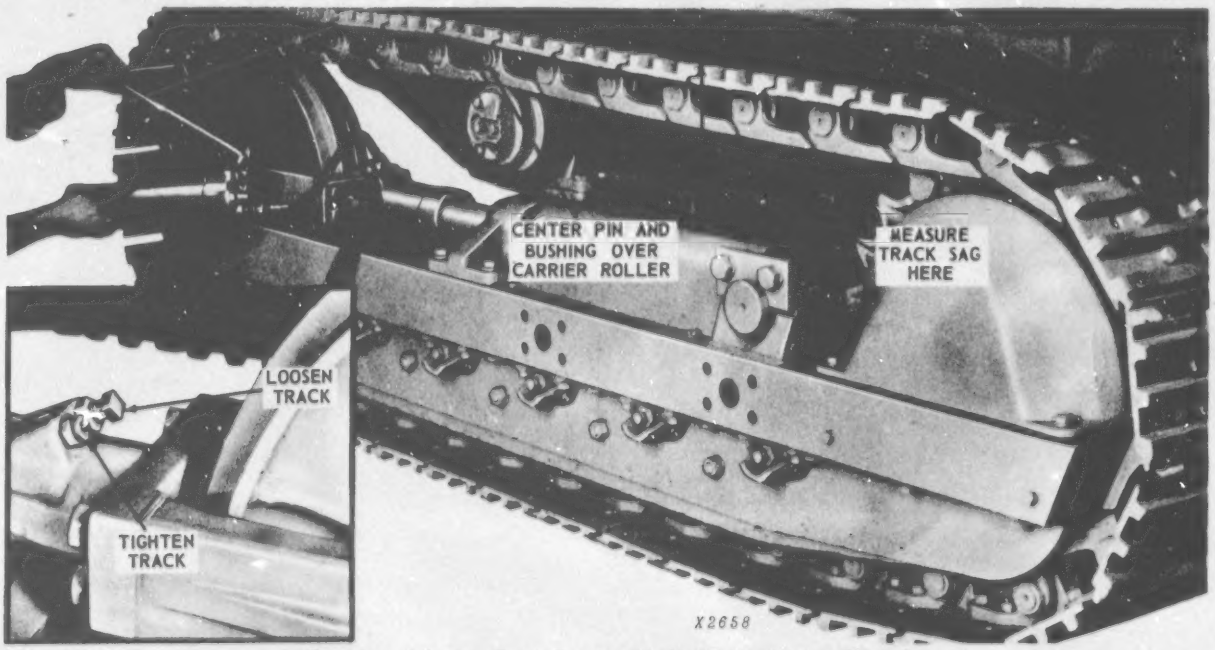


Fig. 11 — Adjusting Track Tension (Hydraulic Mechanism Shown)

Fig. 12 — Track Tension

To check track tension, measure the amount of sag with a straight edge. Be sure to center a pin and bushing over the carrier roller, if recommended. (If the machine has no carrier roller, center a pin and bushing over the front idler.)

Adjust the tension by either turning the mechanical adjuster or by applying or releasing grease on hydraulic adjusters (as shown in Fig. 11).

On hydraulic adjusters, tighten the track by applying grease with the special gun. *(Be sure the gun is not too high-pressure for the mechanism.)* If the piston cannot be moved, disassemble the tension mechanism and free the seized parts.

To loosen the track, turn the relief valve out slightly to relieve hydraulic pressure on the track.

Be sure to adjust each track for equal tension and then check alignment (see below).

Tracks Too Tight — The Results

If a track is adjusted too tight, a great amount of friction will exist between the pins and bushings when the track links hinge as they travel around the sprocket and idler. This friction causes accelerated wear to the pins, bushings, links, sprocket and idler. Friction in a tight track also robs the tractor of horsepower.

Severely tight track adjustment can cause the track to run extremely hot and "draw-back" the hardness of pins and bushings. In some extreme cases the pins and bushings may become so hot that they fuse together.

Also, an extremely tight track adjustment can cause severe damage to the final drive hubs, bearings and gears.

Tracks Too Loose — The Results

If the track adjustment is too loose, service life is similarly reduced.

A loose track fails to stay aligned properly and tends to come off when the tractor is turned, causing wear to the idler center flanges, roller flanges and the sides of the sprocket teeth. A loose track will "whip" at high tractor ground speeds, resulting in impact loads on the carrier rollers and their support brackets.

A loose track tension adjustment also permits the sprocket to jump teeth easily, especially in reverse, causing unnecessary wear to sprocket teeth and track bushings.

Another serious result of operating with a loose track, particularly in the case of large tractors with long track, is failure of track to stay properly aligned with the rollers. This is especially true if the tractor is operating in rocks or subjected to side loading from uneven terrain or side-hills. For example, a tractor operating in rocks and on slopes occasionally will have the front and rear of the track on larger rock and the center of the bottom of the loose track suspended free over the ground. As the tractor moves, the roller flanges will ride up on the track links. This causes a chamfer to be worn on the edges of the links and rapid wear to the roller flanges.

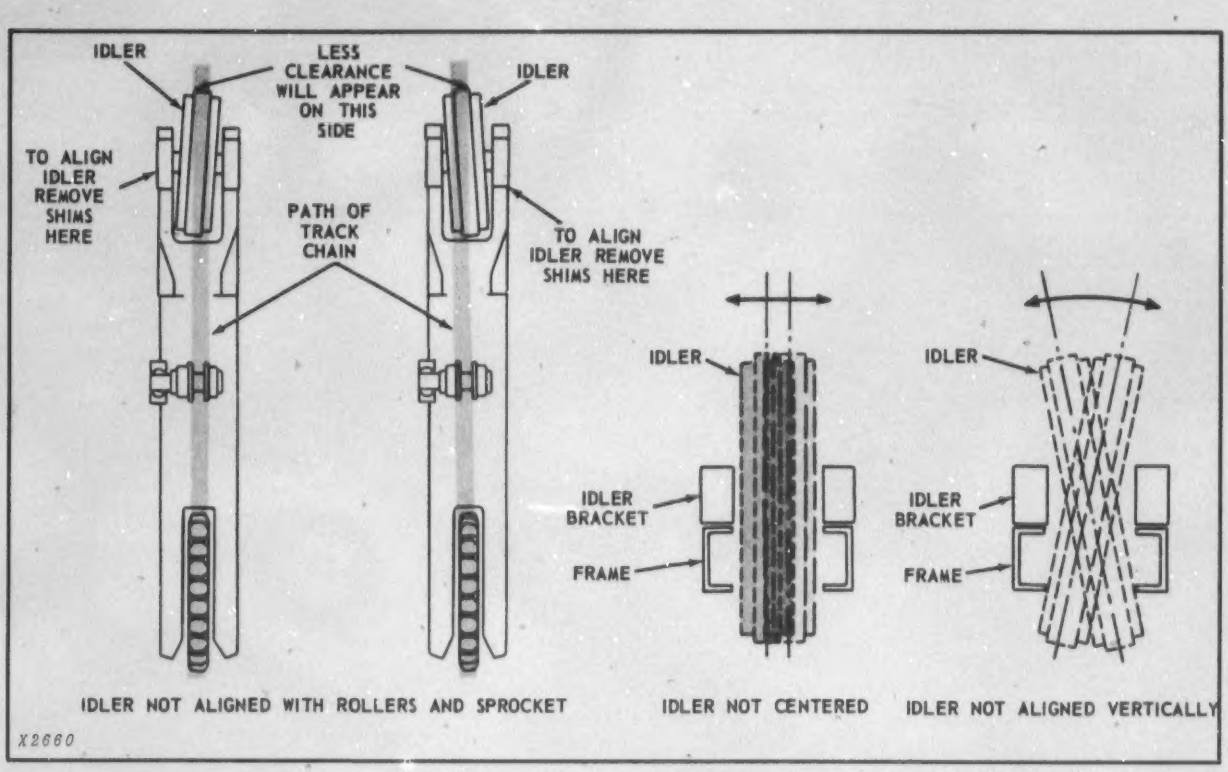


Fig. 13 — Idler Misaligned With Track Parts — Three Examples

TRACK ALIGNMENT

If the sides of the drive sprocket and front idler flanges show heavy wear, the track is probably out of alignment.

The sprocket, rollers, and idler should all be in alignment. The frame and rollers are usually aligned first with the sprocket. Then the idler is aligned with the rollers and sprocket.

Most misalignment occurs at the idler. In Fig. 13 you can see typical examples of idler misalignment. When the idler is not aligned with the rollers and sprocket, the idler ridge, the track links, and the rollers will wear rapidly. If the idler is not centered, the wear will be on only one side.

If wear is evident, check for the cause. To determine if the idler is aligned with the rollers and sprocket, drive forward on level ground for about 100 feet (30 meters). Stop the machine without touching the steering levers. Examine the position of the track links in relation to the front idler flanges (Fig. 14). If clearance is not equal on both sides, adjustment is required. (It may be necessary to remove a shoe as shown to check clearance.)

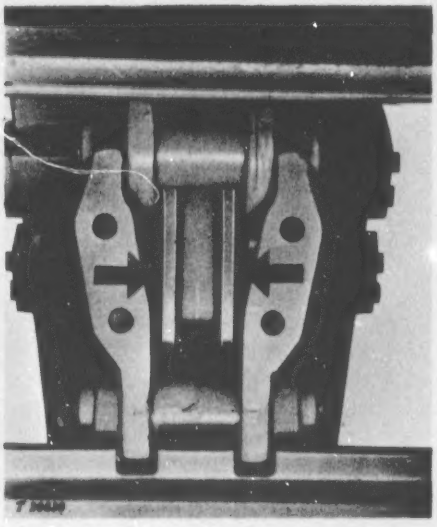


Fig. 14 — Checking for Equal Clearance at Track Front Idler

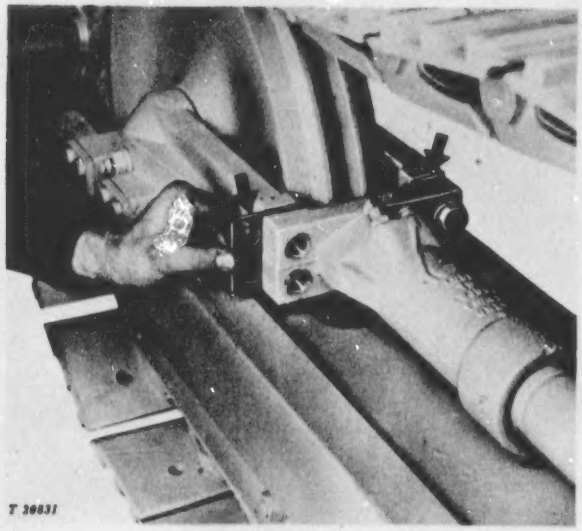


Fig. 15 — Using Shims to Align Idler With Rollers and Sprocket

Notice in Fig. 13 the path of the track chain when the idler is not aligned with the rollers and sprocket. To correct alignment when wear is on both sides of idler, remove the idler adjusting shims (Fig. 15) as required from the side of the idler that has the *least* clearance. Check alignment again after driving forward about another 100 feet (30 meters). If alignment cannot be achieved by removing shims, check for a bent frame.

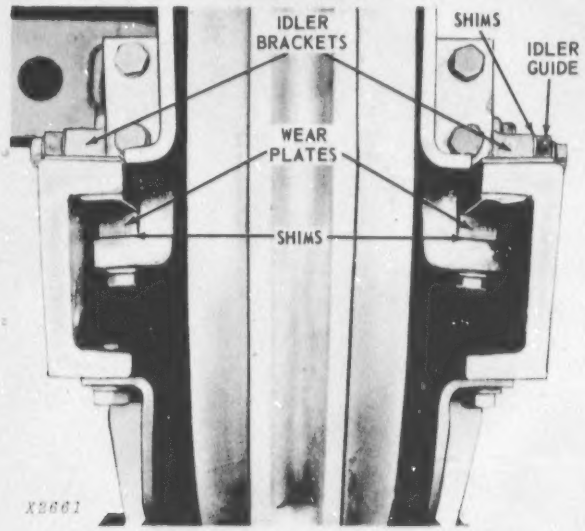


Fig. 16 — Using Shims To Align and Center the Idler

If the idler is worn on one side only, it is not centered or aligned with the rollers. To correct remove or add shims as necessary from each side of the idler bracket (Fig. 16).

To correct vertical misalignment, remove or add shims as necessary on each side of the idler. These shims are usually located between the underside of the frame and the idler bracket, and between the topside of the frame and the idler bracket (Fig. 16).

Another type of alignment is having the tracks aligned with each other and the machine. This is referred to as toe-in or toe-out. Some manufacturers do not recommend any toe-in or toe-out. If no recommendation is given, both tracks should be parallel to each other and the machine. Also, remember that all the misalignments above can be present at once.

If you have difficulty aligning any components, check the track frame for twists or bends. When the frame is twisted, it can often be straightened by changing its position. Do this by loosening and remounting it on the machine. By adding or removing shims from attaching points, the twist can sometimes be corrected.

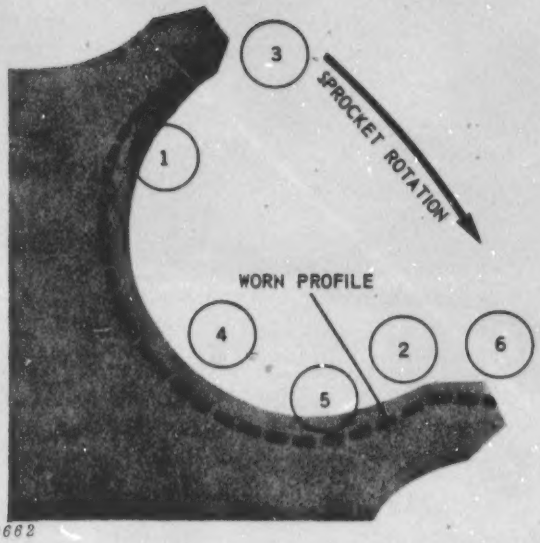
RESULTS OF IMPROPER TRACK ADJUSTMENT

Track Too Loose

1. Extremely fast wear on pins, bushings, and track links.
2. Unnecessary and rapid wear on sides of drive sprocket, teeth and idler wheel flanges.
3. Possible damaged or broken drive sprocket, idler and idler bracket, side frames, and rollers.
4. Track may jump sprocket in both forward and rearward operation. Track may be thrown off when tractor is turned.
5. Noisy track.
6. Frequent accumulation of trash in track.

Track Too Tight

1. Extreme loss of drawbar power and ground speed. Tractor will not handle rated working load.
2. Drifting of tractor to right or left, depending on which track is tighter.
3. Fast wear on pins, bushings, and track links.
4. Excessive and rapid wear on drive sprockets and idler wheels. Extra strain on entire track system because flexibility is lost.
5. Unnecessary wear on final drive bearings and oil seals.
6. Abnormal steering clutch wear.



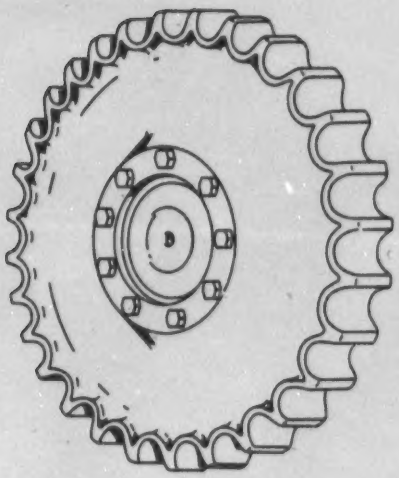


Fig. 17 — Six Major Types of Sprocket Wear

Track Misaligned

1. Drifting of tractor from a direct course.
2. Abnormal wear on idler wheel flanges and front idler flanges.
3. Excessive track link and drive sprocket wear.
4. Rapid steering clutch and brake wear.
5. Operator annoyance and fatigue caused by constantly steering the tractor to keep it from drifting.

DIAGNOSIS OF TRACK WEAR

Track wear is a fact of life. However, a track operated in abrasive sand or rocky conditions cannot be expected to give the service life of one used in soft dirt or snow.

Track components are built tougher today, but they also get harder wear with larger crawlers operated at higher speeds and more horsepower.

Understanding track wear and how to remedy it can be the biggest factor in an effective maintenance program for crawler tractors.

DRIVE SPROCKET WEAR

Sprocket wear is affected by loads imposed, types of terrain, abrasiveness and moisture content of soil. Wear has been reduced by development of the "hunting tooth" sprocket and the machining of sprocket teeth to control shape, root diameter, and backlash.

Wear on sprocket teeth can be identified by careful inspection (Fig. 17). The six major types of wear are:

1. *Drive Side Wear — when operating forward.*
2. *Reverse Drive Side Wear — when operating in reverse.*
3. *Climbing Wear — result of increased track pitch.*
4. *Root Wear — when bushing slides from side to side.*
5. *Rotating Wear — when bushing rotates as it leaves (forward) or enters (reverse) the sprocket.*
6. *Reverse Drive Side Tip Wear — when sprocket pitch is greater than track pitch.*

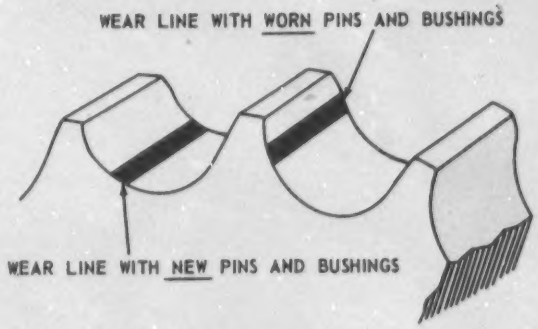


Fig. 18 — Wear Lines On Sprocket Teeth

Wear lines on a new sprocket are shown in Fig. 18. With worn pins and bushings, the wear line is higher on the tooth as shown.

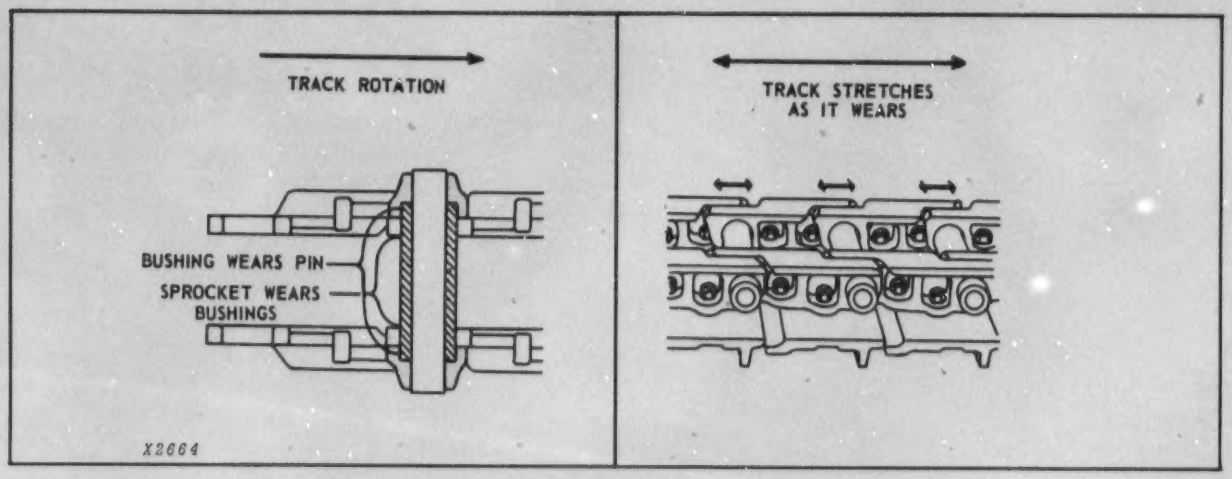


Fig. 19 — Pin and Bushing Wear

PIN AND BUSHING WEAR

The **master** pin and bushing wear more rapidly than other pins and bushings because there is less contact area between the master pin and bushing and because sometimes the master bushing does not extend into the counterbores of the master links.

Because of this more rapid wear, pins and bushings on either side of the master pin for a distance equal to one-half the circumference of the sprocket usually exhibit more wear than the remaining pins and bushings.

Experience shows that periodic replacement of the master pin reduces wear on the adjacent pins and bushings. This in turn reduces sprocket tooth wear.

As pins and bushings wear, the track becomes longer and track adjustment is necessary.

There are two types of wear on pins and bushings — **external** and **internal** (left, Fig. 19).

EXTERNAL WEAR takes place on the bushings in the area contacted by the sprocket driving teeth, which is about 1/3 of the surface of the track bushing.

Due to the fact that wear on pins and bushings does not extend over the entire surface of these parts, the life of worn pins and bushings can be increased by rotating them 180 degrees (Fig. 20, next page). However, the pins and bushings must be turned before they are worn past their wear limits or they will not be serviceable.

INTERNAL WEAR occurs on the outside diameter of the pin, the inside diameter of the bushing, and outside diameter of the ends of the bushing if they fit into the track link counterbores.

This wear can be determined by measuring the center-to-center distance between the track pins, and is indicated by the amount of track tension adjustment remaining. When the track adjustment limit is reached and the track is too loose, sufficient internal wear has occurred and the pins and bushings should be turned.

Allowing pins and bushings to be run to destruction can result in depreciation of all track components affected by operating with a loose track adjustment. Also, the pitch of a track with badly worn pins and bushings is greater than the pitch of the drive sprocket teeth, and may cause sprocket "jumping," resulting in rapid depreciation of sprocket teeth.

However if the sprocket is also worn, rotated pins and bushings will continue to wear at a faster rate, unless the sprocket is replaced.

When To Turn Worn Pins And Bushings

There are three basic checks to determine when pins and bushings should be turned:

1. *Check wear lines on drive side of sprocket teeth.*
2. *External wear on bushings.*
3. *Internal wear on pins and bushings (by measuring across several track links).*

Use all three checks, but when any one of these points is worn to the wear limits, turn the pins and bushings. To measure wear, see the next section of our story.

NOTE: Refer to the machine Technical Manual for actual wear limits on track parts.

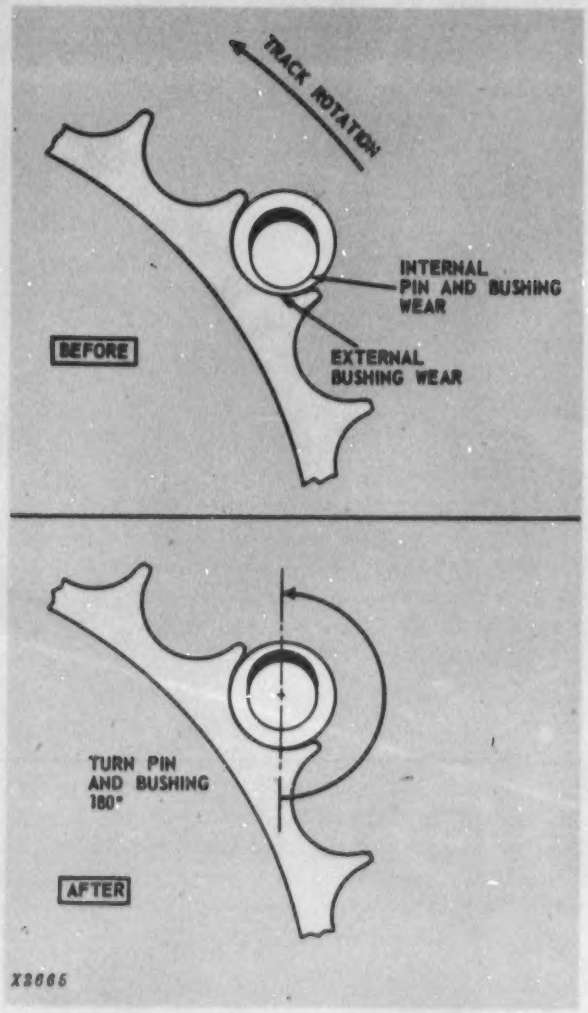


Fig. 20 — How Worn Pins and Bushings Can Be Rotated To Restore Them

Pin and Bushing Wear When Operating In Reverse

Reverse operation causes a higher rate of wear on track pins and bushings because all the load is concentrated on one sprocket tooth. (In forward, loads are spread over several teeth.) This accelerates wear, making it doubly important to *slow down in reverse*. Wear increases as speeds increase.

ROLLER WEAR

All track rollers under a tractor do not wear at the same rate and, if recommended, rollers can be switched in somewhat the same manner that tires are switched on automobiles.

Changing the position of rollers, in some cases, distributes the wear and extends the service life of the roller group as a whole. If this is done, change the rollers approximately midway in their service life.

Occasionally, in some operations, a roller may wear more on one flange than another. In this case, the roller can be switched end-for-end, when recommended.

It is very important that the flanges of the front and rear rollers be in good condition to guide the track properly under the intermediate rollers and the sprocket.

IDLER WEAR

Keep idlers in proper alignment. A misaligned idler will cause wear on the idler center flange, the sides of the track links, the sides of the roller flanges, and on the track roller guards.

If the wear from the misaligned idler is confined to one side only, the idler is probably not properly centered (see Fig. 13). Shims are provided beneath plates on the idler end bearings to center the idler with respect to the track rollers.

MEASURING TRACK WEAR

Now that we have seen the causes and effects of track wear, let's determine the amount of wear by measuring it.

Track wear can be measured in two ways:

- **Measuring Tools**
- **Special Wear Gauges**

MEASURING TOOLS such as ruler, tape measure, depth gauge, and calipers (Figs. 21 and 22) will give you exact wear to one-hundredth of an inch (0.25 mm). By comparing the wear to the manufacturer's wear limits, you can tell if track parts must be reconditioned.

SPECIAL WEAR GAUGES (Fig. 23) are supplied by some track manufacturers as a rough guide for track wear. However, these gauges do not accurately indicate wear — only if the part is half worn out, worn beyond the wear limits, etc.

CAUTION: Stop the engine before making any track measurements or adjustments.

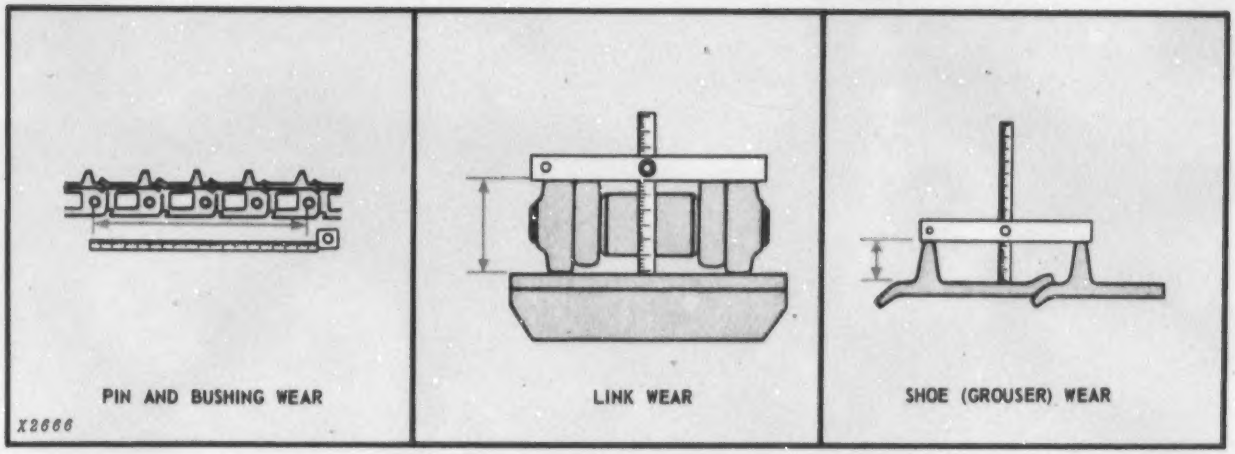


Fig. 21 — Measuring Wear On Pin and Bushing, Link, and Grouser (With Measuring Tools)

Using Measuring Tools

Pin and Bushing Wear — The track must be taut to make this measurement (Fig. 21, left). Place an old track pin between two sprocket teeth and back up until the slack is taken out of the track. Measure from the side of any pin across several links to the same side of another pin as shown. Be sure the master pin is *not* included among any of these pins. Divide this measurement by the number of links you measured across. This will tell you how much the pin and bushings have worn internally when you check the figures against the manufacturer's new dimensions.

Link Wear — Measure the height of the link with a depth gauge and compare it to specifications.

Shoe (Grouser Wear) — Measure the height of the shoe grousers and determine how much they are worn.

Roller Wear — Measure roller radius with a ruler when roller guards are installed as shown at left in Fig. 22. Subtract "C" from "B" to determine roller radius "A".

Bushing and Roller Wear — Track bushing and roller wear can be measured with calipers as shown in center, Fig. 22. Transfer the established diameter to a ruler and compare with wear limit tables.

Idler Wear — For idler wear, measure the height of the flanges with a depth gauge. Check specifications for recommended wear tolerances.

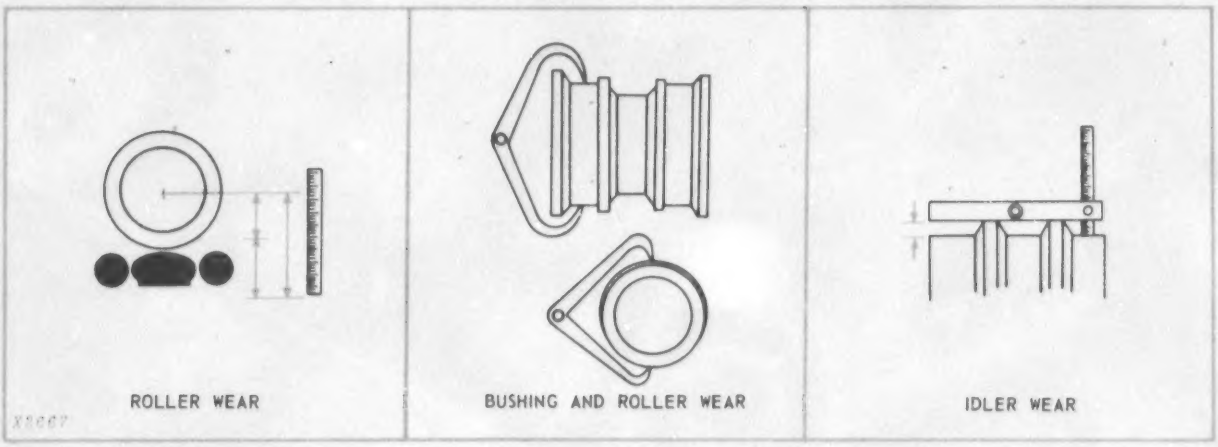


Fig. 22 — Measuring Wear On Rollers, Bushing, and Idler (With Measuring Tools)

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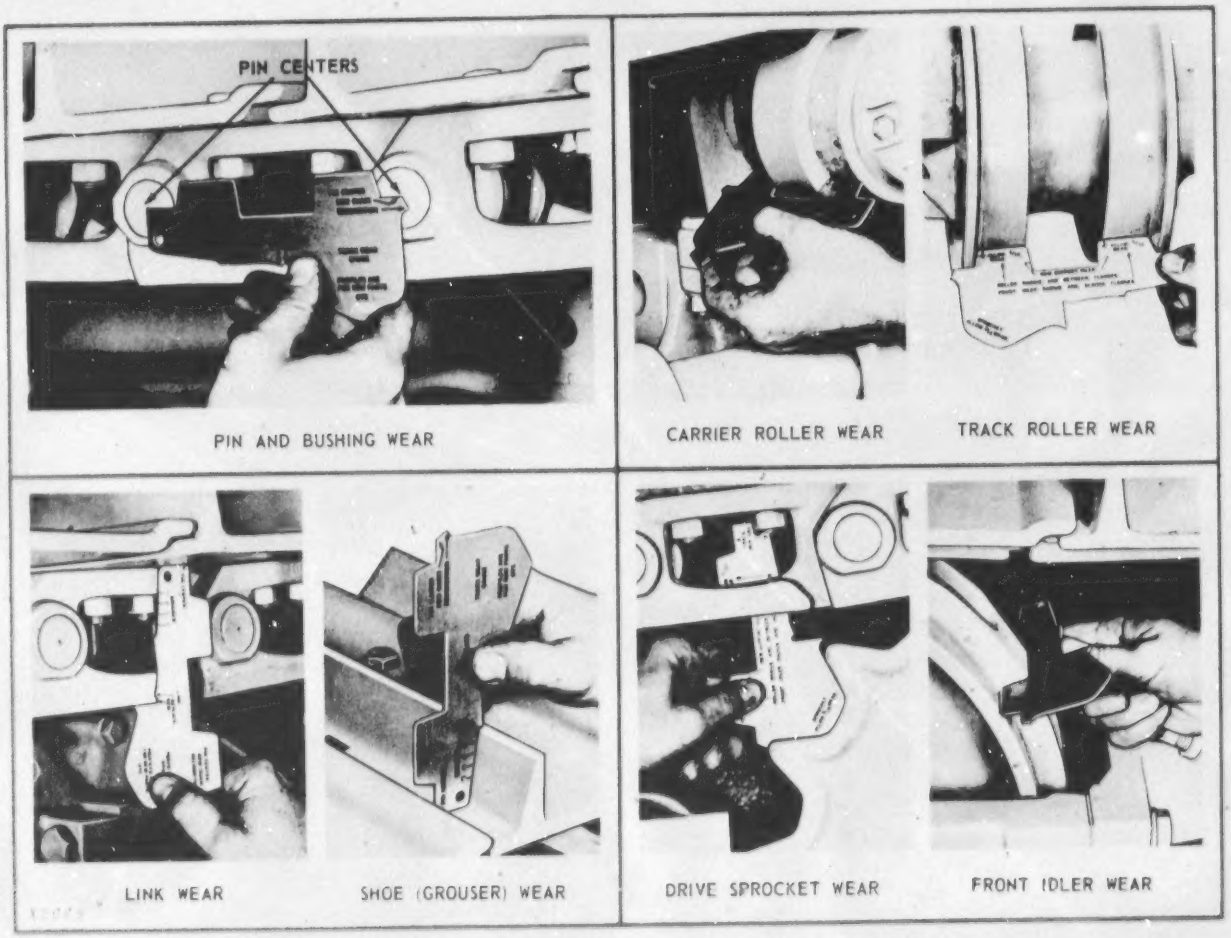

Fig. 23 — Measuring Track Wear With a Special Wear Gauge

Using A Special Wear Gauge

The instructions below are for a typical wear gauge supplied by one track manufacturer. The shape and markings on the gauge will vary for different tracks.

Pin and Bushing Wear — The track must be taut to make this measurement. Place an old track pin in a sprocket tooth and back up until the slack is taken out of the track. Position the gauge on the track link as shown at upper left in Fig. 23. Place the corner of the gauge marked "Pin Center" at the center of one pin and the other end of the gauge at the center of the next pin. If the point of the gauge marked "New Chain" falls at the center of the pin, the track chain does not require servicing. If the point marked "Recondition" falls on the pin center, the track pins and bushing are probably worn.

Link Wear — Position the gauge on the track link as shown at lower left in Fig. 23. With the top of the gauge (end with hole) against the track shoe, check the positions of two arrows on the gauge in relation to the bottom of the link. The link is worn if the arrow marked "Replace" is at the bottom edge of the link.

Shoe (Grouser) Wear — To measure the amount of wear on the grouser lugs, position the gauge upright and against the grouser lug as shown in Fig. 23. The point on the gauge at which top of the lug falls is the amount of wear on the grouser track shoe.

Carrier Roller Wear — Place the gauge over the roller support so that the large cutout is over the raised portion of the idler (see upper right in Fig. 23). The lines on the gauge will match the outer edge of the center flange on a new idler. Wear is indicated by how far the center flange passes the lines on the gauge.

Track Roller Wear — The roller will wear on the sides and the outer surface of the roller flanges. Place the gauge between the roller flanges as shown in Fig. 23. Allowable wear on the outer surface and side of rollers is shown by the arrows on the gauge.

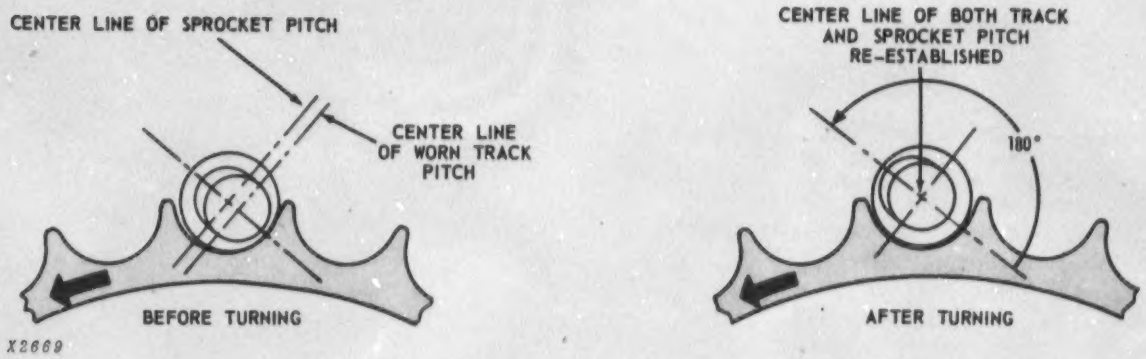

Fig. 24 — Rotating Worn Pins and Bushings 180 Degrees

Sprocket Wear — Place the rounded portion of the gauge against a root of the sprocket as shown. Compare wear to manufacturer's wear limits.

Front Idler Wear — The front idler has a tendency to wear on the sides and outer surface of the idler flanges. Place the large cutout notch of the gauge over the idler flanges as shown. Push the gauge to one side against the side of the idler flange. Allowable wear is shown by arrows on the gauge.

REPAIRING TRACKS

Now that we have seen what causes wear and how to measure it, let's see what can be done to correct it.

The biggest service problem with tracks is pin and bushing wear. As we saw earlier, worn pins and bushings can be rotated 180 degrees to renew track pitch — *provided* they are not worn beyond the limits (Fig. 24).

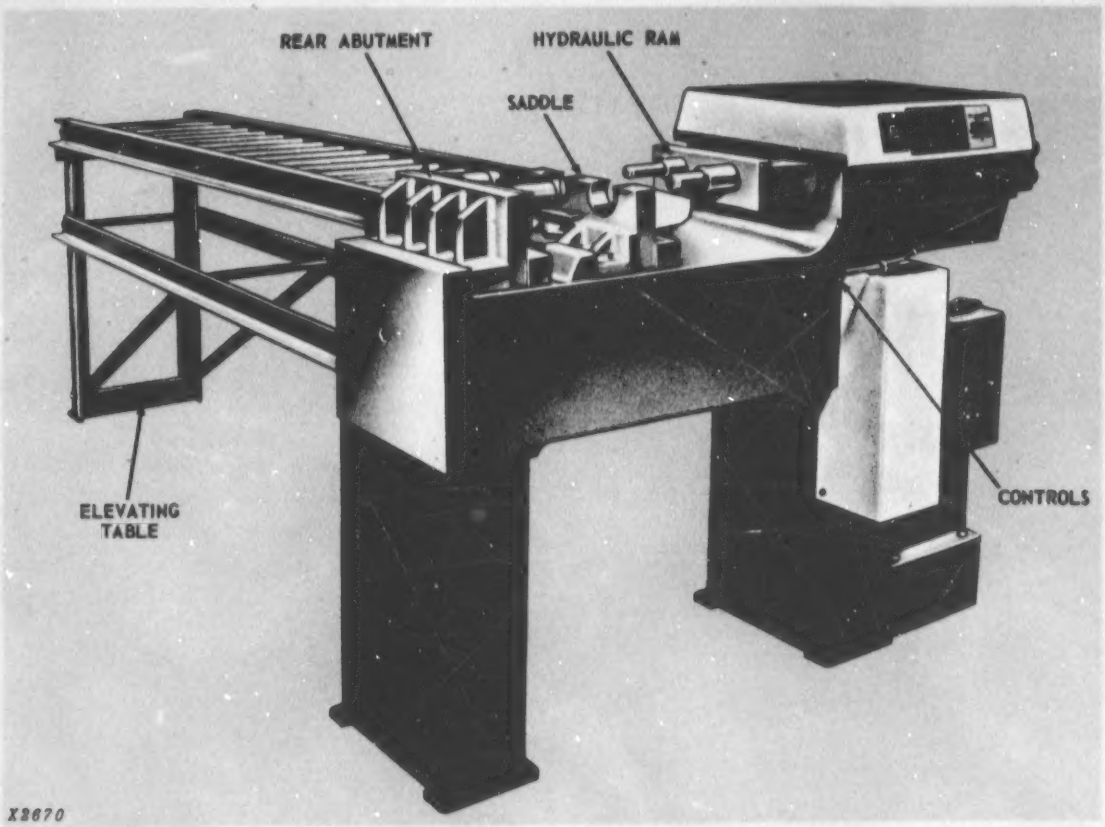

Fig. 25 — Track Press Designed To Disassemble Tracks

However, it may be more economical to replace the pins and bushings with new parts. This will depend upon the cost of new parts versus the costs of labor. In either case, the service procedure is much the same.

The pins and bushings in the track assembly are made of extremely hard material and are a press fit. For this reason, the track cannot be disassembled without a **track press** similar to the one shown in Fig. 25.

Track presses are made in many types by many manufacturers. Some are stationary presses (shown), while others are trailer-mounted models which may be towed to the job.

Most of these presses provide tools, jigs, and fixtures for all operations in disassembling and reassembling various tracks.

Two service methods with two sets of press adapting tools are available for track service:

- **Interlock-type service**
- **Flush-type service**

The INTERLOCK-TYPE service method is used when it is not desirable to push the pin and bushing completely through the link assembly. Both flush-type tracks and interlocking-type tracks (see Fig. 6) may be serviced by the interlock-method adapting tools.

With the FLUSH-TYPE service method, the pin and bushing must be pushed through the link assembly. The adapting tools for this method will accommodate only flush-type tracks (see Fig. 6).

Let's look at track removal and disassembly for each method.

NOTE: We will show only a typical track repair job. Since tracks vary, refer to the machine Technical Manual for details.

REMOVING TRACKS FROM MACHINE

To remove tracks from machine in the shop, do the following:

1. Raise one side of track by placing a floor jack securely under the front crossbar or at recommended point.

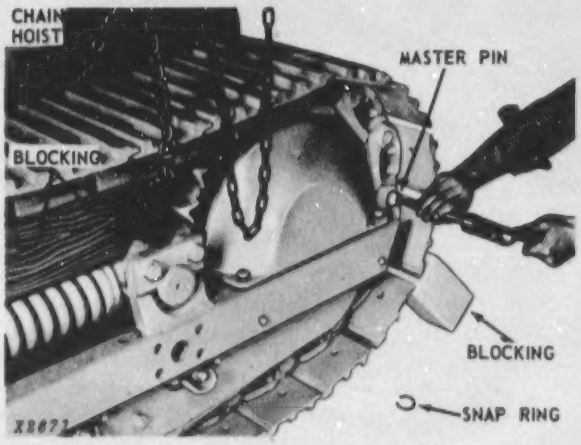

Fig. 26 — Removing Tracks From Machine

2. Start engine and shift transmission into first gear.

3. Pull back on steering lever that controls track not raised off ground (to brake it).

4. Engage engine clutch and allow raised track to rotate until master pin has moved around drive sprocket until about 6 inches from the floor (Fig. 26).

CAUTION: Be careful that machine does not move and that rotating track is clear of floor.

5. Release all tension from the track to be removed.

6. Place blocking under track near drive sprocket as shown to loosen track for easier separation.

7. Remove snap ring and drive out master pin as shown in Fig. 26.

CAUTION: Do not hammer on hardened pins and bushings. Dangerous flying chips may result.

8. Using a chain hoist, pull track up and toward front of machine until clear of drive sprocket.

CAUTION: Keep hands and feet away from track during separation.

If other track is to be removed, repeat these steps.

In the field, tracks can be removed by separating at the master pin and driving the machine off the tracks onto planks.

TRACK DISASSEMBLY -- INTERLOCK METHOD

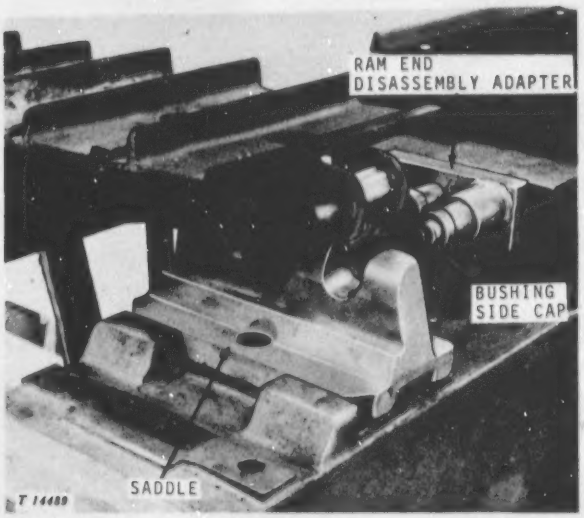

Fig. 27 — Installing Saddle and Ram End Disassembly Adapter

Install the proper saddle and secure it to the track press frame.

Adjust the conveyor extension to the desired conveyor working height.

Remove the outside row of cap screws (row away from work head of press) that secure the track shoes to the link assemblies.

Install the ram end disassembly adapter to the work head of the press and secure it (Fig. 27). Install the bushing side cap to the disassembly adapter and secure it.

Raise the elevating conveyor and move the track chain assembly toward the press operator until the link assembly bushing is directly over the top of the saddle.

Lower conveyor so that the chain link assembly is indexed into the saddle.

Advance the work head of the track press until the cam and disassembly adapter come in contact with the bushing and pin. Press the bushing and pin from the right-hand link. Remove the right-hand link with shoe as an assembly (Fig. 28).

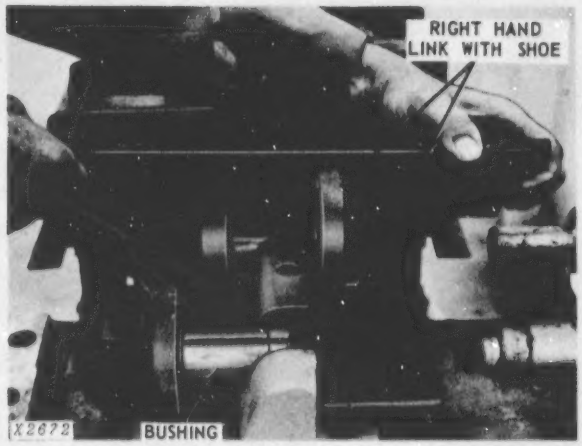

Fig. 28 — Removing Right-Hand Link With Shoe

Remove the left-hand link assembly, which includes the bushing and pin, from the saddle.

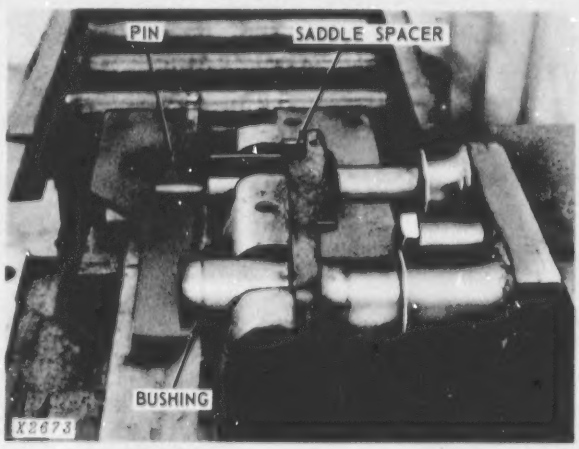

Fig. 29 — Removing Bushing and Pin From Left-Hand Link

Install the saddle spacer into the saddle as shown in Fig. 29. Advance the work head of the track press and remove the bushing and pin from the left-hand link.

Repeat these steps until the track is completely disassembled.

TRACK ASSEMBLY — INTERLOCK METHOD

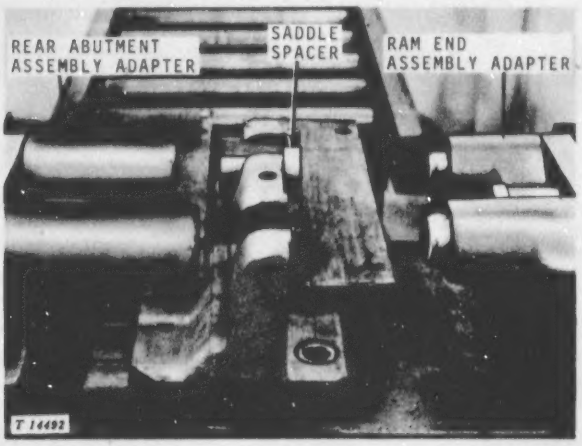

Fig. 30 — Preparing Press For Track Pin and Bushing Installation

Remove the cam end disassembly adapter from the press head and install the assembly adapter. Install the rear abutment assembly adapter on the press as shown in Fig. 30. Do not remove the saddle or saddle spacer.

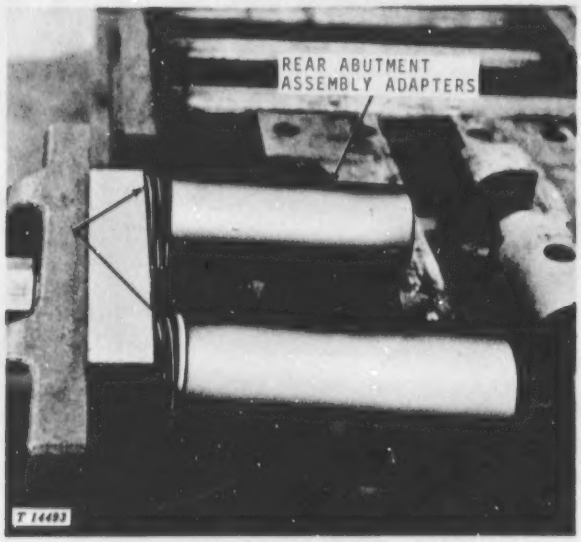

Fig. 31 — Installing Shims Behind Abutment Adapter Block

Install shims behind the rear abutment assembly adapter blocks to align abutment blocks so that the link assemblies move freely after assembly (Fig. 31). If the link assemblies are pressed too tightly together, the track will be stiff. As a result, the track will be difficult to install and will wear rapidly.

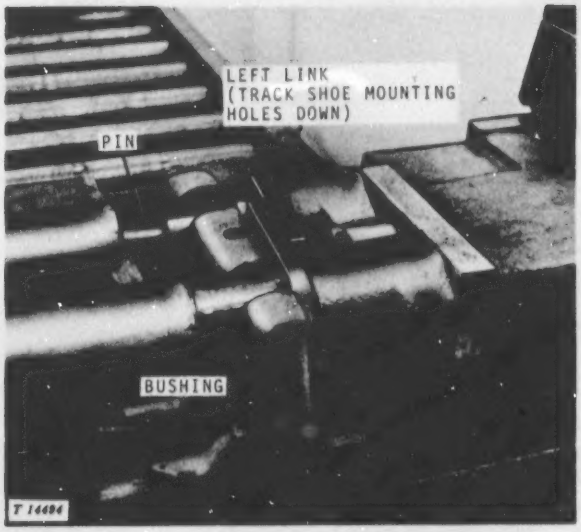

Fig. 32 — Installing Left-Hand Link To Pin and Bushing

With the pin and bushing in the saddle, position the left-hand link with the track shoe mounting holes down between the saddle and the work head of the press as shown in Fig. 32. Advance the work head of the press and press the link onto the pin and bushing.

NOTE: The track shoe mounting holes are in the down position. After the link is pressed onto the pin and bushing, it becomes the left-hand link assembly.

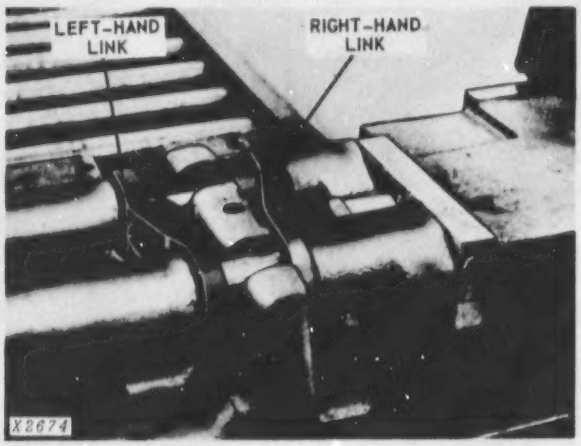

Fig. 33 — Installing Right-Hand Link To The Left-Hand Link

Install the right-hand link, with track shoes attached, into proper position. (Shoe is removed for illustration purposes.) Advance the track pressure work head and press the right-hand link onto left-hand link as shown in Fig. 33. Carefully continue to advance the work head until the right-hand link

assembly is properly positioned so that the bolt holes in the track shoes align with the bolt holes in the left link.

NOTE: One link assembly should be completely assembled before assembling the various components. This is recommended because it may be necessary, depending upon link wear, to vary the number of adjusting shims behind the rear abutment assembly adapter blocks.

Continue these steps with each link assembly until the track is completely assembled.

TRACK DISASSEMBLY — FLUSH-TYPE METHOD

NOTE: It is not necessary to remove the track shoes when replacing the pins or bushings unless individual side link replacement is necessary.

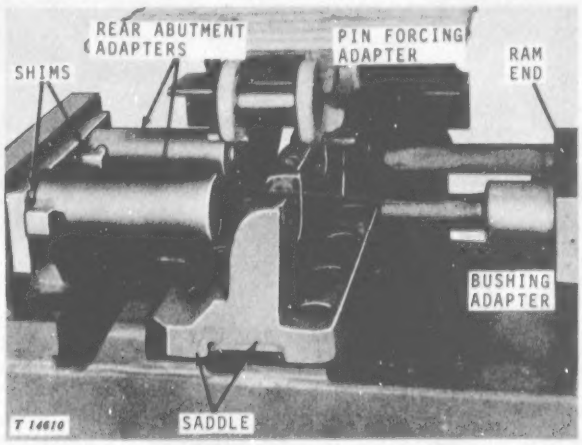

Fig. 34 — Installing Ram End For Disassembly

1. Install the rear abutment adapter with the necessary shims (Fig. 34).

NOTE: Due to the friction wear on the side links, the number of shims required will vary. Leave as little space as possible between side link and rear abutment adapter to eliminate any bending stress on the side links when pins and bushings are removed and installed.

2. Install the saddle and secure it to the track press frame.

3. Adjust the conveyor extension to the desired conveyor working height.

4. Install the pin forcing adapter and the bushing adapter on the ram end. Position the ram end on the work head of the press and secure it (Fig. 34).

5. Raise the elevating conveyor and move the track chain assembly toward the operator until the bushing of the link assembly is directly over the top of the saddle.

6. Position the new bushing over the bushing adapter on the ram end.

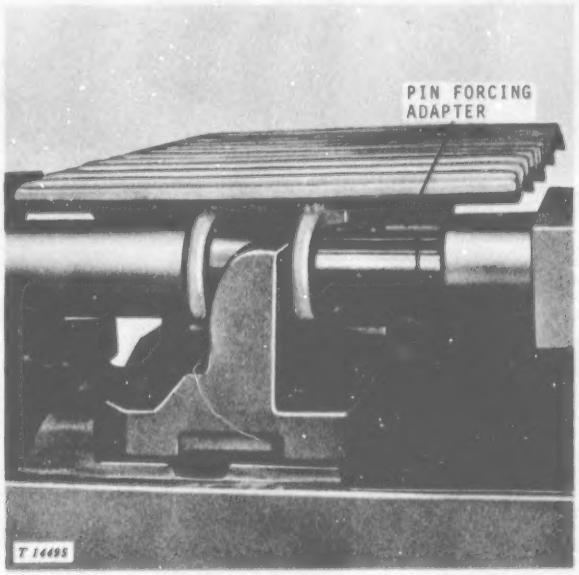

Fig. 35 — Removing Pins and Bushings

7. Lower the conveyor so that the chain link assembly is indexed into the saddle.

8. Advance the work head of the track press until the pin forcing adapter and bushing adapter (with a new bushing) push the pin and old bushing out of the link assembly (Fig. 35).

9. Retract the work head of the track press and raise the elevating conveyor. Remove the link assembly with the new bushing from the track chain assembly.

10. Advance the track assembly and install a new bushing on the bushing adapter. Lower the conveyor so that the chain link assembly is again indexed into saddle.

11. Keep on removing pins and forcing out the old bushing with a new bushing until each link assembly is removed from the track assembly.

TRACK ASSEMBLY — FLUSH-TYPE METHOD

1. Remove the ram end from the working head of the press. Remove the pin forcing adapter and bushing adapter from the ram head.

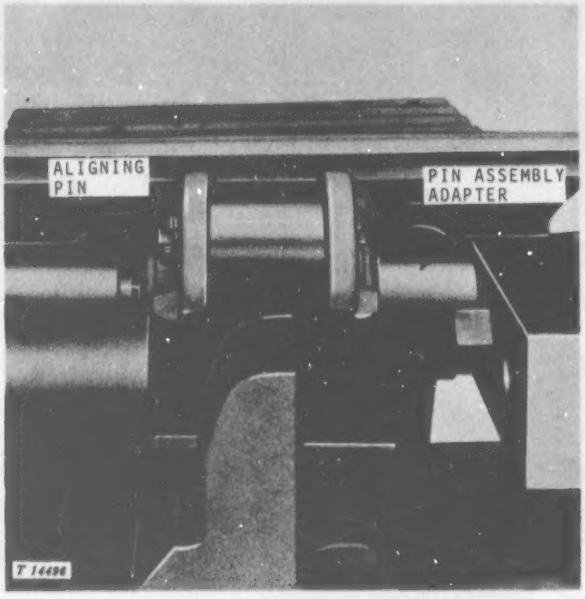

Fig. 36 — Connecting Track Chain

2. Secure the pin assembly adapter to the ram end. Position the ram end on the work head of the press and secure it (Fig. 36).

3. Place one link assembly in position in the saddle so that the bushing rests in the saddle slot nearest the conveyor.

4. Place the second link assembly in position so that the side links straddle the bushing end of the first link assembly. Place the second link bushing in the saddle slot nearest the track press operator. (The link assembly is shown raised in Fig. 36 for illustration only.)

5. Align the link assemblies with the aligning pin. Hold the new track in position and advance the work head of the press. The new pin will push the aligning pin out as the new pin enters the link assembly.

6. Retract the work head of the track press and raise the elevating conveyor to free the link assembly from the saddle. Lower the conveyor and install another link assembly.

7. Continue these steps with each link assembly until the track chain is completely assembled.

INSTALLING TRACK ON MACHINE

To install the track in the shop, do the following:

1. Place assembled track on floor under track rollers. Be sure track is facing correctly. Rear end of track should be about in line with rear of drive sprocket.

2. Using a chain hoist, pull track up over front idler and rear sprocket.

3. Place a block of wood between upper part of carrier and track to take out sag.

4. Use a crowbar in the master pin hole if necessary to pull the ends of the track together. Line up holes by driving on links with a soft hammer.

5. Index head of master pin if necessary and drive pin into place. Install snap ring.

6. Align track and adjust tension as given earlier in this story.

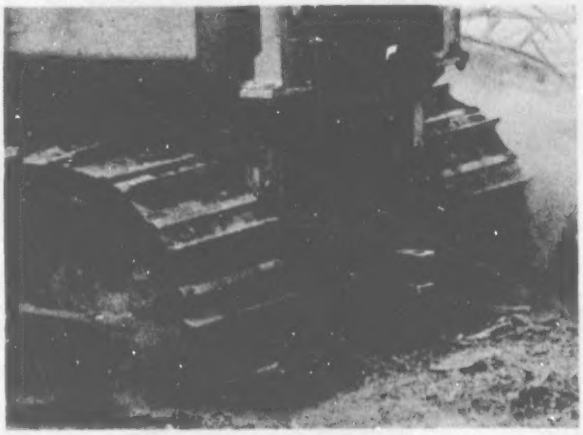

Fig. 37 — Tracks Represent Fifty Percent Of The Maintenance Cost Of a Crawler Tractor

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TROUBLE SHOOTING CHART FOR TRACKS

Refer to this guide for possible causes of track problems.

Fast wear on pins, bushings, and track links.	1. Track too loose. 2. Track too tight. 3. Track misaligned. 4. Sprocket badly worn. 5. High-speed operation.
Rapid wear on sides of sprocket teeth, idler, and rollers.	1. Track misaligned. 2. Sprocket or idler misaligned. 3. Track too loose.
Track whips and damages other components.	1. Track too loose. 2. Idler frozen in back position.
Track jumps sprocket or is thrown off.	1. Track too loose.
Noisy track.	1. Track too loose.
Frequent accumulation of trash in track.	1. Track too loose.
Loss of drawbar power.	1. Track too tight.
Drifting to right or left.	1. One track tighter than the other. 2. Track misaligned.
Abnormal wear on final drive bearings and oil seals.	1. Track too tight. 2. Track misaligned.
Abnormal wear on steering clutch and brake.	1. Track too tight. 2. Track misaligned.

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TEST YOURSELF

QUESTIONS

1. How do interlocking track chains differ from flush-type chains?

2. Explain "hunting tooth" design of drive sprockets.

3. Why should the grease fitting on the track tension adjuster never be lubricated?

4. What is normal sag for most tracks?

   a. ½ inch (0.13 mm)

   b. 1 inch (25 mm)

   c. 2 inches (51 mm)

5. What can cause fast wear on track parts?

   a. Too-loose tracks

   b. Too-tight tracks

   c. Both of the above

6. When pins and bushings are worn, will the wear line on the mating sprocket teeth be higher or lower than with new parts?

7. How can worn track pins and bushings be restored?

8. What happens to the length of the track as the pins and bushings wear?

9. How do you measure for pin and bushing wear using a tape measure?

10. What is the function of the master pin in the track? How is it different from the other pins?

11. Match each problem at left below with one of the causes at right.

a. Rapid wear on sides of idlers and rollers.	1. Track too loose.
b. Abnormal wear on final drives.	2. Track misaligned.
c. Track jumps sprocket.	3. Track too tight.

ANSWERS

1. Interlocking chains have their bushings extending into the counterbores of the links. This keeps out more abrasives.

2. Only every other tooth engages a track bushing as it rotates. This reduces sprocket wear. (Sprocket has an odd number of teeth.)

3. Because it will overtighten the track.

4. b — 1 inch (25 mm)

5. c — Both.

6. Higher.

7. By rotating them 180 degrees.

8. The track gets longer, or "stretches."

9. Measure across several links from one pin edge to the same edge of another. Divide the measurement by the number of links and compare to the manufacturer's wear limits.

10. To allow easy removal when separating the track. The master pin has a head and is held in place by a snap ring.

11. a — 2; b — 3; c — 1.

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